33rd Year

MARCH, 1950

RUBBER AGE

SIMPLIFY YOUR LATEX COMPOUNDING.....

USE OUR STANDARD AQUEOUS DISPERSIONS

INDIVIDUAL MATERIALS

AND

COMPLETE VULCANIZING COMPOUNDS

READY MADE FOR YOU TO STIR INTO YOUR LATEX

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Now—available from Du Pont easy-to-handle

MBTS GRAINS

We are pleased to announce that Du Pont can now supply your MBTS requirements in grain form.

We think you'll want to evaluate easy-to-handle MBTS Grains in your own compound and mill rooms.

Remember, too, that Thionex and Thiuram M are also available in grain form. The excellent acceptance they've had is proof of the advantages they offer under actual plant conditions.

Tune in to Du Pont "CAVALCADE OF AMERICA" Tuesday Nights—NBC coast to coast

● If you have not already obtained samples, see your Du Pont representative or write:

E. I. du Pont de Nemours & Co. (Inc.)
Rubber Chemicals Division
Wilmington 98, Delaware

DU PONT RUBBER CHEMICALS
E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.

DU PONT
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BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

THE RUBBER AGE, published monthly by The Palmerton Publishing Co., Inc., Printing Office, East Stroudsburg, Pa. Editorial and Advertising Offices at 250 West 57th Street, New York 19, N. Y. Entered as second class matter October 20, 1933, at the Post Office at East Stroudsburg, Pa., under the Act of March 3, 1879. Subscription in United States, $3.00 a year; Canada, $3.50; Foreign, $4.00. March, 1950, Vol. 66, No. 6.

HYCAR

helps keep the pressure on

Safely!

HYCAR VALVE SEAT*

The valves illustrated are products of The Weatherhead Company, Cleveland, Ohio (patents pending).

THOSE safety relief valves pictured above are doing a protection job never before possible. And Hycar American rubber helped "turn the trick"!

It did it when ways were being sought to make handling of propane in cylinders and tanks safer. Formerly-used resilient valve seats in the safety relief valve couldn't always be relied upon. Some rubbers would actually vulcanize to the valve seat, flow excessively under constant load, or swell due to the presence of propane. Excessively high relief pressures resulted.

When Hycar was tested, it met all requirements—solved the problems perfectly. The Hycar valve seat does not stick or vulcanize to metal. Pressure settings may be made which remain substantially constant over long periods of time. Tanks and cylinders of propane can be transported or used with maximum safety.

Hycar
Reg. U.S. Pat. Off.
American Rubber

There are even more advantages with Hycar. Its stability in the presence of propane and other hydrocarbons is excellent. It resists extreme high and low temperatures, is resilient, and has high abrasion resistance. Hycar can be compounded and molded to extremely close hardness tolerances.

Perhaps Hycar can help you improve a product, or develop a new one. We'll gladly help you with technical service and information. Just write Department HA-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

**Hycar valve seat molded by Acushnet Process Company, New Bedford, Mass.*

B. F. Goodrich Chemical Company A DIVISION OF THE B. F. GOODRICH COMPANY

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When you've got a really tough job to do, call on Philblack O! There's no luck about it . . . you get uniformly good results *every time* . . . with synthetic or natural rubber. Laboratory tests . . . and grueling work-outs on the road with various sized tires . . . prove that Philblack O plus "cold" rubber produces the highest quality tire treads ever offered to the public! Excellent flex life. Outstanding resistance to cut and crack growth. Remarkable ability to withstand abrasion. Long mileage records! Send for your trial order of Philblack O today!

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6 reasons

why you should use PLIOLITE S-6

1 **Excellent compatibility and reinforcement with commonly used natural and synthetic rubbers.**

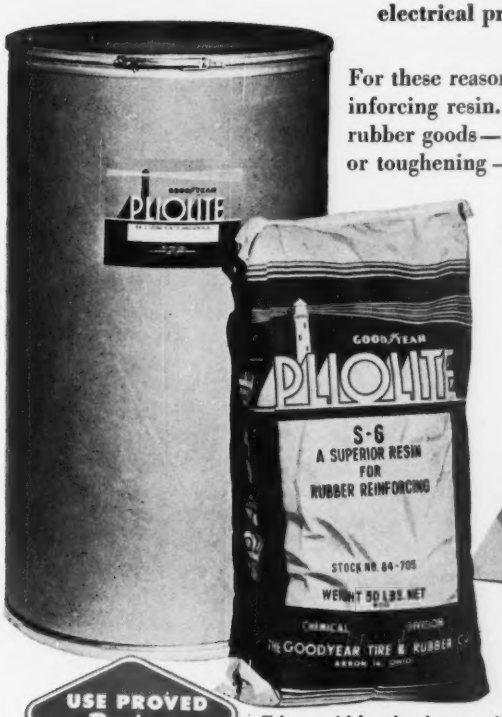
2 **Readily incorporated on the mill or in the banbury.**

3 **Thorough dispersion.**

4 **Excellent physical and electrical properties.**

5 **Conveniently packaged in drums, bags or masterbatch in cartons.**

6 **Top technical service available.**



For these reasons, **Pliolite S-6** is the most widely used rubber reinforcing resin. In shoe soles, flooring, wire insulation or molded rubber goods — wherever a compound needs stiffening, hardening or toughening — you'll find that **Pliolite S-6** does the job better.

For further details on **Pliolite S-6** and samples of this outstanding reinforcing agent, write:
GOODYEAR, CHEMICAL DIVISION,
AKRON 16, OHIO

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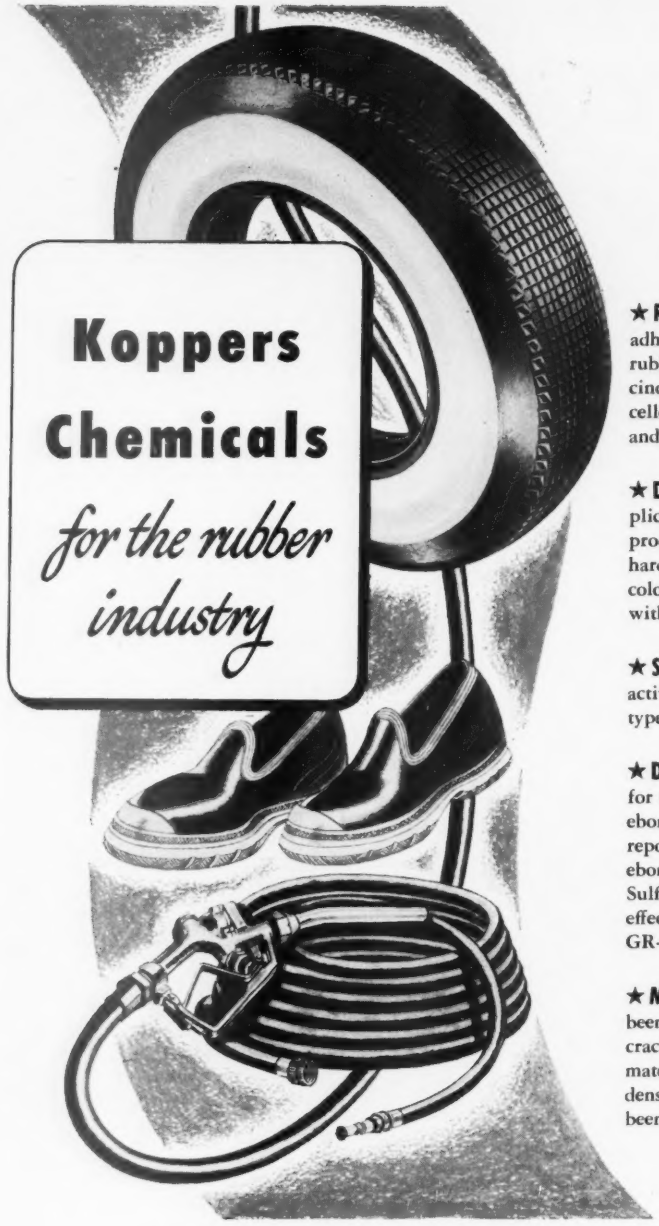
Take your pick from these three convenient packages

GOODYEAR

Pliolite—T.M. The Goodyear Tire & Rubber Company

We think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network



★ **RESORCINOL** is used for preparation of adhesives that assure a strong bond between rubber and fabric or cords. Koppers Resorcinol used in pre-dip treatment produces excellent bonding of rubber to cotton, rayon and nylon fabrics.

★ **DI-tert-BUTYL-para-CRESOL** has wide application as an antioxidant in white rubber products. It retards cracking, checking, hardening or loss of strength without discoloring the product or staining materials with which the product comes in contact.

★ **STYRENE MONOMER** polymerizes with active olefinic compounds to produce GR-S type synthetic rubbers.

★ **DI-tert-BUTYL-meta-CRESOL** is suggested for use in the preparation of hard rubber or ebonite from GR-N synthetic rubbers. It is reported to improve tensile strength of ebonite and increase tackiness of the stock. Sulfides of DBMC have been reported to be effective peptizing agents for reclaiming of GR-S type synthetic rubbers.

★ **MONO-tert-BUTYL-meta-CRESOL** has been reported to be an effective anti-flex cracking agent in rubber and rubber-like materials. And the resin obtained by condensation of MBMC with formaldehyde has been shown to impart tack to GR-S rubber.

WRITE FOR INFORMATION ON THESE CHEMICALS

Koppers has prepared a new bulletin containing information and structural formulae on 26 synthetic chemicals offered in commercial quantities, including these five chemicals of special interest to the rubber industry. For your copy, write to Koppers Company, Inc., Chemical Division, Dept. RA-3, Pittsburgh 19, Pa. Ask for Bulletin C-9-103.

KOPPERS

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Chemical Division

Pittsburgh 19, Pa.

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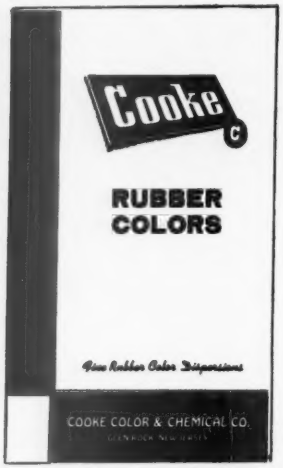
ASTROLITH* Lithopone
ZOPAQUE* Titanium Dioxide
CADMOLITH* Cadmium Red and Yellow Lithopone



Have you received your copy of our new Color Chart? If not, send for a copy today!

COOKE'S
—the Proved Rubber Colors

COOKE Colors are quality rubber colors—they assure a permanent, clean tone in your products, and can be used in Natural and Synthetic Rubber and in Vinyl Plastics.

COOKE Colors will stand all cures and are non-bleeding and non-migrating. They are furnished as soft dispersions made up of equal proportions of organic toner and neutral polymer. They have high stability and ease of handling which assure an exact color control of the finished product.

These colors are unsurpassed for aging properties and will stand long storage and temperature changes. Another outstanding feature of Cooke Colors is their depth of color and high tinctorial value, for which they have gained general recognition in the rubber industry.

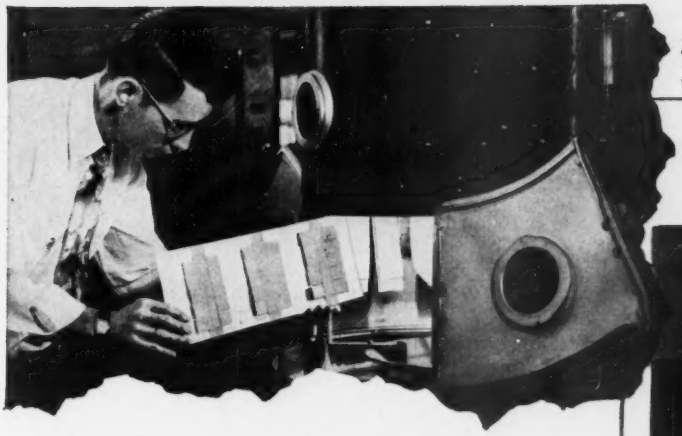
There are more than 20 colors in the Cooke line—a color for every job. If the shade you desire is not in our color chart, the colors may be blended to get the exact shade you require. Or, if you prefer, we will supply blends to meet your individual requirements.

Cooke

COOKE COLOR & CHEMICAL CO.

GLEN ROCK, NEW JERSEY

Plant and Laboratory: Hackettstown, N. J.



Fade-O-Meter test-checks discoloring of various anti-oxidants. Panel, below, shows superiority of Wing-Stay S compared with six leading anti-oxidants. Center strip is unexposed white control stock.

FADE-O-METER TESTS
Show Superiority

Here's why YOU should use *Wing-Stay S*

The Superior Non-Staining Anti-Oxidant

HERE'S proof that WING-STAY S is an exceptional non-staining, non-discoloring anti-oxidant:

The panel at the right shows that WING-STAY S, when compared in natural rubber with six of the most popular anti-oxidants, was unmatched in maintaining color. In addition, it was among the best in providing protection to the rubber in the O_2 bomb, the N_2 bomb, the Geer Oven and the Fade-O-Meter.

But these pictures tell only part of the story. You can have the same advantages of WING-STAY S in GR-S by simply purchasing GR-S 26 from your usual source! It is incorporated in GR-S 26 at the time of its manufacture, and gives the same degree of protection as realized in natural rubber.

Another big point for WING-STAY S is its low cost. This new anti-oxidant gives the best balance of cost, protection, and non-discoloring properties available on today's market.

Final proof of all this is the fact that large quantities of WING-STAY S are being purchased every month, although it was only recently introduced. Why don't you follow the lead of many rubber compounders—find out about WING-STAY S now?

For full details and sample, write:

GOODYEAR
CHEMICAL DIVISION
AKRON 16, OHIO

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Wing-Stay—T. M. The Goodyear Tire & Rubber Company

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A SYNTHETIC RUBBER

of the acrylonitrile type manufactured under U. S. Patented process and supplied by the Heresite & Chemical Company.

HERECROL IS AVAILABLE AS FOLLOWS:

1. Latex.
2. Compound — not cured.
3. Sheet form.
4. Liquid for coating purposes.

SPECIAL PROPERTIES OF HERECROL:

1. Excellent solvent, oil, and chemical resistance.
2. High tensile strength and elongation.
3. High resistance to oxidation and aging.
4. Wide temperature range of service.

For full information and free sample write to

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WE COVER THE WATERFRONT

on Water-Based Latex Materials:

LOTOL* Compounded Latices—Ready to Use.

KRALAC* Plastic Latices.

NITREX Butadiene Acrylonitrile Copolymer Latex.

SHRINK-MASTER Process for Rendering Woolens Shrink Resistant and Long Wearing.

LATEX Natural and Synthetic.

KANDAR* Permanent Finish for Textiles.

KOLOC* Cationic Resin Compositions for Cotton, Rayon and Wool.

NAUGATEX* Dispersed Chemical Compounding Ingredients for all Latices.

KRALASTIC Flexible Plastic Latices.

DISPERSITE* Aqueous Dispersion of Rubber, Reclaimed Rubber or Resins.

*Registered U. S. Patent Office

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In use for over 20 years, Linerette is a quality, specification sheet that provides a quick and easy way to separate stock without adhesion. Linerette preserves the tackiness of the stock and contains no oil or wax which might migrate.

LINERETTE is furnished in any width up to and including 54", in rolls of 9", 11½", 13", and 15" diameters; put up on 3" i. d. cores. The yield is approximately six square yards to the pound. A 9" roll contains 375 linear yards and a 15" diameter about 1150 linear yards.

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***Cable Address:* "BLUELINER"**

ILLUSTRATED LINER BOOKLET

Tells all about Climco Liners and Linerette and how to get better service from liners. Write for your copy now.

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LINERETTE

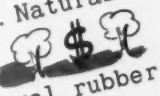
INTERLEAVING PAPER

CLIMCO

CLIMCO

FOR YOUR INFORMATION

subject: Natural Rubber

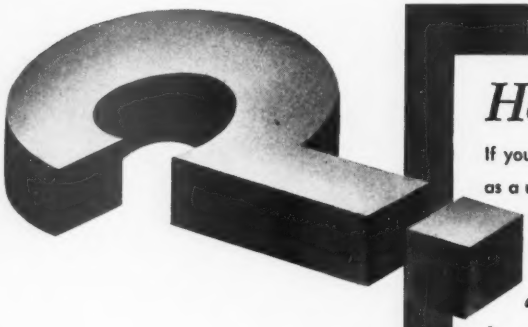
Natural rubber is the key to the economy of Southeast Asia, a stronghold of democracy in the East. Natural rubber is the top dollar-earner  of the sterling countries. Natural rubber is one of America's most important imports — essential in war and in peace.

To supply you with information about natural rubber, the Natural Rubber Bureau has been set up by the rubber producing industry. For facts, figures, photos about real rubber, call the Bureau. Write for the "Natural Rubber News" a monthly summary of current developments in rubber. Also for new market survey reports and booklets on such new uses as latex foam cushioning and rubber roads.

Natural Rubber Bureau
1631 K Street, N. W. Washington 6, D. C.

Nature and Science
Serving Mankind

WHY St. Joe lead-free Zinc Oxide



Here is the Answer:

If you were to name the principal factors that you—as a user of zinc oxide—would consider all-important when choosing a supplier, wouldn't this be the line-up?

a. Integrity and experience of the manufacturer.

b. High quality and uniformity of the product.

c. The producer's ability to deliver, *on time*, the precise type of pigment and the quantities you need.

On those, *and many other counts*, the St. Joseph Lead Company stands out. As a result, ST. JOE American Process, Lead-Free ZINC OXIDES have for years been specified by many manufacturers who are known for the high quality of their own products.

ST. JOSEPH LEAD COMPANY
250 PARK AVENUE • NEW YORK 17 • ELdorado 5-3200
Plant & Laboratory, Monaca, (Josephtown), Pennsylvania

Cancelling "Holidays" in a COATING'S CALENDAR

Look closely at the picture above, and you'll see a spark jumping from the metal test panel to the electrode in the technician's left hand.

That means the coating on the panel is not in a continuous film or is broken . . . protection thereby is not complete. We say the coating has a "holiday" in it.

Sometimes these "holidays" aren't visible to the naked eye. So Flintkote researchers use this method of testing electrically to be *certain* that the coatings tested meet the conditions for which they were formulated. When the tell-tale spark appears . . . back the coating goes for further development until it passes every test with flying colors.

And this is only one of literally hundreds of painstaking tests that Flintkote researchers make on every product. Housed in one of the most modern, efficiently equipped buildings in the industry, the staff of this new research laboratory sets the pace for Flintkote plants from coast to coast . . . to assure better products and better results consistent with lowest possible costs.

Whether your problem is one of coatings for sound deadening, protection from water or weather, fume resistance or acid corrosion . . . adhesives or floorings . . . see what we have now and can offer you for the future.

THE FLINTKOTE COMPANY
Industrial Products Division
30 Rockefeller Plaza, New York 20, N. Y.

FLINTKOTE
Products for Industry

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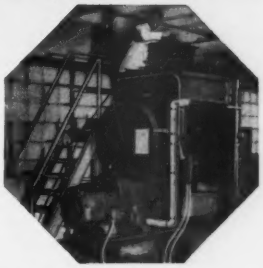
Washington • Toronto • Montreal

⬆ One or more of 24 separate laboratories constantly evaluate Flintkote products step by step from raw materials to field performance, from initial development to mass production. Both Company and Customers profit by this *insurance from research.*



This "pilot scale" ribbon type mixer ➡ enables the laboratory to reproduce production conditions quickly and accurately for research and testing of a variety of asphalt mastics.

⬅ Scientific equipment in use here permits complete analyses when only minute quantities, sometimes no larger than a pinhead, are available. Techniques like this assure purity, reduce cost, speed operation and increase accuracy in the Flintkote Laboratories.

This small scale rubber mill is used to ➡ break down various rubber materials to just the right consistency for use in new products or processes. Full size operation follows in the production of versatile fluid rubber and rubber-like adhesives, coatings and sealers.

Yes, you will profit, as have many others, if you write to EEMCO for their proposition on Rubber and Plastics Processing Machinery. Engineered right, built right and of best obtainable materials you are assured of longer life and better production when you select EEMCO. If your present or future needs include any of the machines listed below, write EEMCO for a quotation. You will like their attractive prices and quicker deliveries. Standard and custom made, of course.

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CRACKERS
LABORATORY MILLS
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RUBBER AND PLASTIC
MACHINERY DIVISION

Engineered for YOUR product

PELLETEX is endowed with physical and chemical properties which make it an ideal carbon black pigment for rubber manufacture. Outstanding among these is a softness which gives a remarkable ease of dispersion and processing; good aging at low and high volume loadings; and low volume cost.

A predominant characteristic of compounds containing PELLETEX is their superior rubbery feel and flexibility, even with high volume loadings. The low heat build-up of PELLETEX rubber compounds makes them preferred above all others for certain uses.

PELLETEX

PELLETEX for superior compounds

The GENERAL ATLAS Carbon Co.

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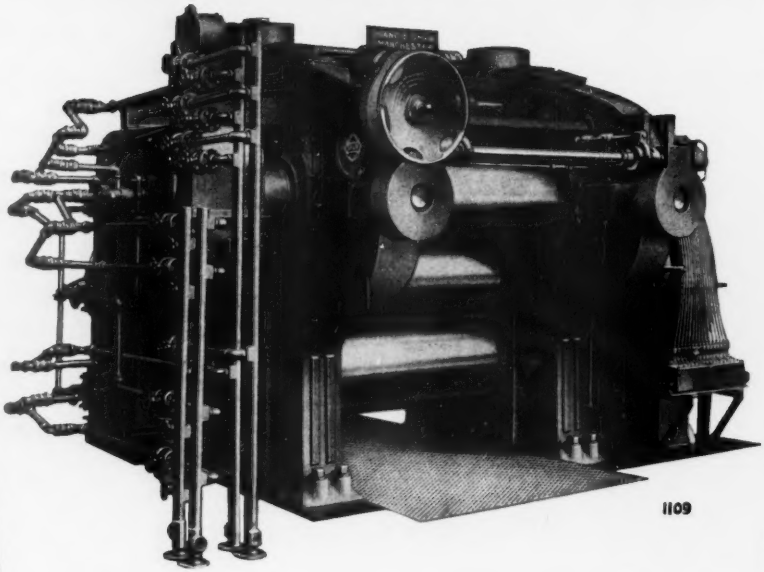
H. N. Richards Company, Trenton • The B. E. Dougherty Company, Los Angeles and San Francisco • Delacour-Gorrie Limited, Toronto

CALENDERS OF MERIT



The Calender shown has four rolls 68" long by 24" diameter, arranged to give even or friction speeds. The off set, top and bottom rolls can be adjusted by motor or by hand. Oil lubrication is provided from the oil pump to all parts which run continuously. Grease gun lubrication is provided to the more static moving parts. Where high temperatures are used for plastic materials our calenders are equipped with flood lubrication to the bearing blocks.

We supply the auxiliary equipment such as warmers, drying and cooling drums, batch-up and let-off gear, etc.

FRANCIS SHAW & CO. LTD. MANCHESTER 11 ENGLAND

R 163

CARBON BLACKS

UNITED CARBON COMPANY, INC.

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NEW YORK • AKRON • CHICAGO • BOSTON

Close-up of coolers, precipitators, and cyclone collectors in one of the twelve units of our furnace black plant at Ryus, Kansas.

KOSMOS 40

It is . . .

A furnace black — HMF type.

Made from natural gas.

Well balanced in physical and chemical properties.

Always uniform in quality.

Highly reinforcing.

Easy-mixing, quick-tubing, tight-curing.

It is Used . . .

In tire treads and inner tubes.

In sidewalls and carcass stocks.

In mechanical goods.

Alone or blended with other United blacks.

And adapted for wide applications.

It is available . . .

For immediate shipment.

To meet your specifications.

In pelleted, dustless form.

Clearly branded.

Coded to your wish.

In 25lb or 50lb bags.

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AND Kosmos 40 will put your products in a high quality range. Standardize on Kosmos 40.

RESEARCH DIVISION

UNITED CARBON COMPANY, INC.

Charleston 27, West Virginia

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  - Aero AC-165
- Guanidine
  - DPG (Diphenylguanidine)
  - DOTG (Diorthotolylguanidine)
  - Accelerator 49

ACTIVATORS
- Aero AC 50

PEPTIZER
- Pepton 22

PLASTICIZER
- Plasticizer 42 (For Neoprene)

RETARDER
- Calco Retarder P. D.

STIFFENING AGENT
- Calco S. A.

SULFUR
- Rubber Maker's Grade

Calco
REG. U. S. PAT. OFF.

AMERICAN Cyanamid COMPANY
CALCO CHEMICAL DIVISION
INTERMEDIATE & RUBBER CHEMICALS DEPARTMENT
BOUND BROOK, NEW JERSEY, U.S.A.

A LOW COST BUNA N PLASTICIZER

PANAFLEX BN-1

EXCELLENT FOR *Light Colored* PRODUCTS!

PANAFLEX BN-1 is an economical, light-colored plasticizer for synthetic rubber — especially butadiene-acrylonitrile type.

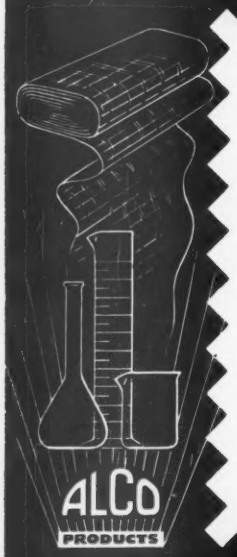
This new hydrocarbon plasticizer *completely* replaces dibutyl phthalate in nitrile rubbers — produces soft vulcanizates having high tensile, excellent elongation, and very low modulus. **PANAFLEX BN-1** plasticized stocks possess good ageing properties, superior electrical characteristics, and show good gasoline and oil resistance.

SPECIFY GRAVITY	0.9440
COLOR, NPA	1½
REFRACTIVE INDEX	1.553
DISTILLATION, °F	560-730
ODOR	Excellent
VISCOSITY, SSU @ 100°F	240

SAMPLES ON REQUEST

PAN AMERICAN DIVISION *Pan American Refining Corp* Chemicals

122 East 42nd Street, New York 17, N. Y. — PAN AMERICAN — Plant: Texas City, Texas



AN IMPORTANT ANNOUNCEMENT

Alco Oil & Chemical Corporation is now in a position to supply their new

VULCARITES

AQUEOUS DISPERSIONS OF RUBBER CHEMICALS

The VULCARITES are useful for the preparation of rubber and vulcanizable resin latices. In addition to the standard VULCARITES such as those of sulfur, zinc oxide, anti-oxidants, accelerators and blends of them, specially prepared VULCARITES are available on request to meet specific latex compounding problems.

★ ★ ★

Samples and technical information available promptly on request.

ALCO OIL & CHEMICAL CORPORATION

TRENTON AVE. and WILLIAM ST., PHILADELPHIA 34, PA.

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WICA COMPANY INC.

CHARLOTTE, N.C.

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PARADENE
NEVOLL
R-16

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NEVOLL • R-GRADES
X-1 RESINOUS OILS

WHITE WALL TIRE STOCKS

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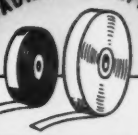
R-6 • R-17 • R-29

Why not call on Neville's years of research and experience for help on your rubber production problems?

ADHESIVE TAPE



PARADENE
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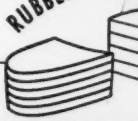
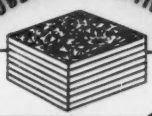
RUBBER SOLES & HEELS



PARADENE
R-12 • R-16 • R-16[A]

RUBBER FLOOR TILE



R-12 • R-16
LX-685

• Products listed are all coumarone resins except Nevoll and X-1 Resinous Oil

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Chemicals for the Rubber Industry

R-49

An important announcement to all Rubber Molders:

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NOW OFFERS YOU

An improved, more efficient Silicone Release Agent to help you mold better products

A new General Electric silicone emulsion for use as a mold release agent in the rubber industry offers important advantages to users.

This new emulsion (G-E 81161) has been thoroughly tested in the laboratory. It has already been used commercially, and accepted, by the largest rubber manufacturers. The introduction of this improved emulsion was purposely withheld until everyone concerned with the evaluation of the product was satisfied that it was right *in every respect.*

Here are some of the special features that this new G-E silicone emulsion 81161 offers users:

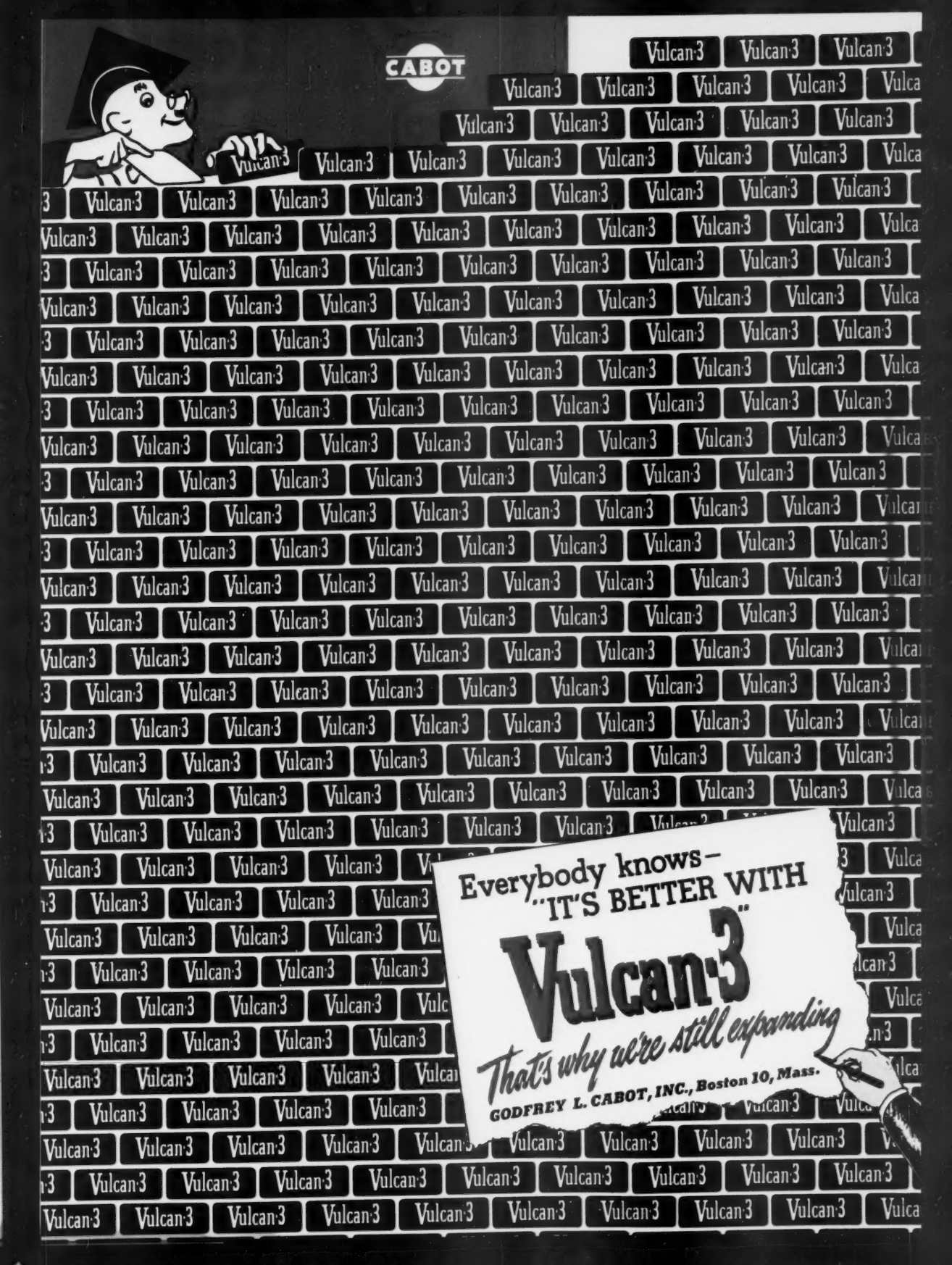
1. **Superior mold coverage—better performance on intricate molds.**
2. **Exceptional stability at room temperatures and above—it remains stable up to 150 F.**
3. **Hard water stability; it remains stable *24 hours at 750 PPM* in ½% dilution.**
4. **Stability under mechanical working; won't break or cream under *repeated* recycling in centrifugal pumping system.**
5. **Will not stain light-colored stocks.**

G-E 81161 is suitable for mold spray or bag dip. It is rust-inhibited, it has low toxicity, and many other important advantages. We suggest you *try* it yourself—see in your own plant how you can turn out better molded products, cut rejects, and increase production by reducing mold down time for cleaning. Write today for more details. Address Section J1, Chemical Department, General Electric Company, Pittsfield, Massachusetts.

Silicones for Industry

GENERAL ELECTRIC

CD50-J1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8172

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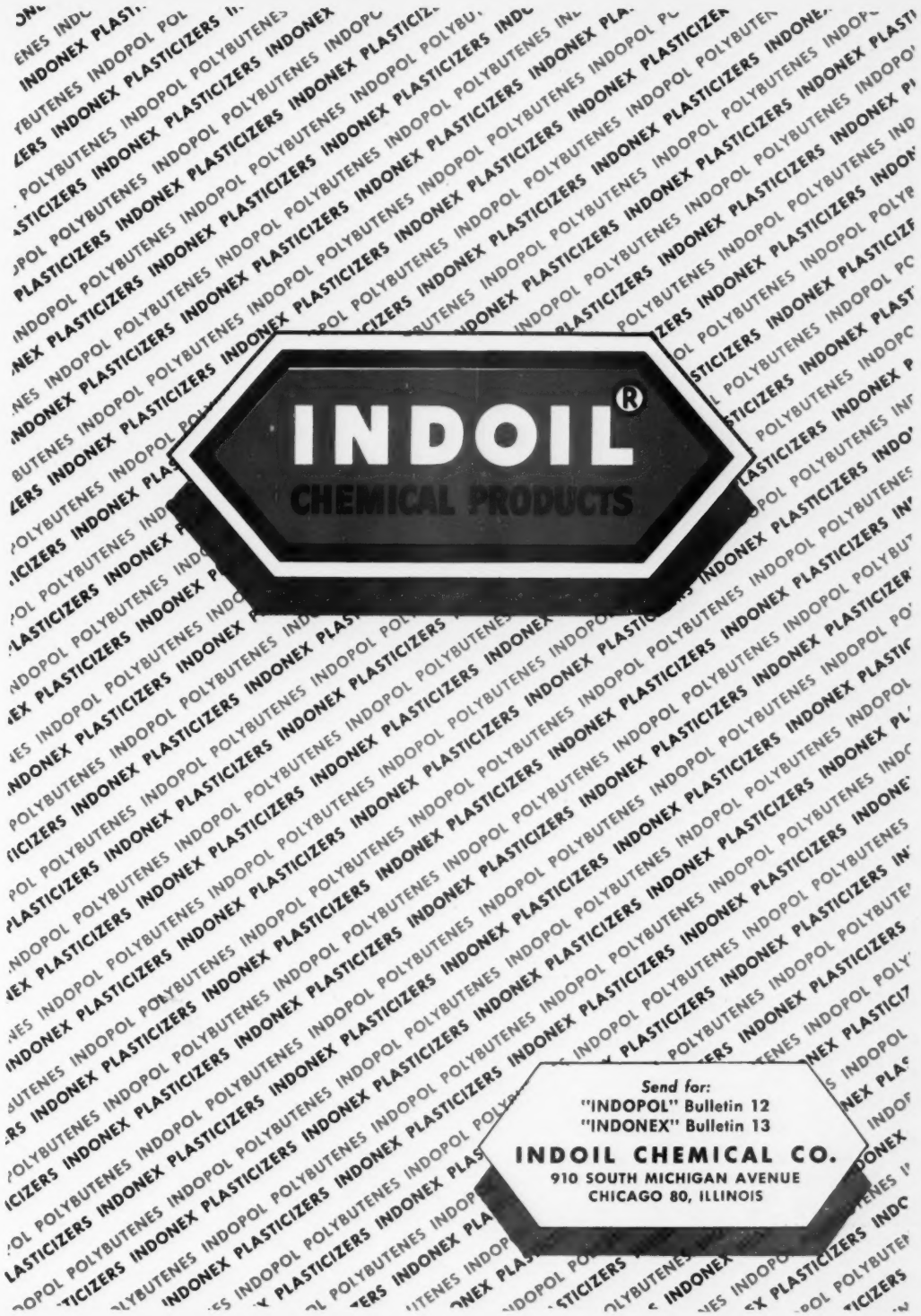
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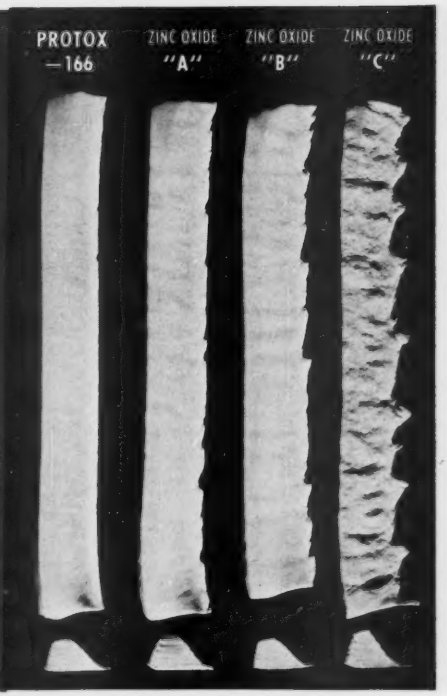
SPEED UP PROCESSING with...

PROTOX-166

(THE COATED ZINC OXIDE)

Tubing, like other processing operations, is faster... smoother... easier... with PROTOX-166 than with other Zinc Oxides. This is illustrated by extrusions (at right) based on equal parts of natural rubber and Zinc Oxide. The four Zinc Oxides used in this comparison represent a wide range of particle sizes and types. The tubing data on each stock are given in the table below.



In your search for better processing Zinc Oxides, don't overlook PROTOX-166(1). It incorporates faster, disperses better, and makes for more plastic stocks that calender and tube easier.

These features of PROTOX-166 stem from its unique composition—a base of Horse Head(2) XX-4 and a coating of zinc propionate. No other Zinc Oxide has such a widely-accepted base or such a coating.

When you compare PROTOX-166 with other Zinc Oxides of normal particle size, you will find that it steps up your compounds in many ways... Higher Tensile Strength... Better Tear Resistance... More Pendulum Rebound... Increased Modulus.

TUBING PROPERTIES OF ZINC OXIDES IN NATURAL RUBBER

PIGMENT	WILLIAMS Plasticity (70°C @ 3 min.)	WILLIAMS Recovery (1 min.)	MOONEY Viscosity (ML100°C @ 3 min.)	MOONEY Recovery (30 sec.)	½ ROYLE(3) Extrusions (grams/min.)	SWELLING(4) %
Protox-166	1.94	0.07	34.5	84	52.0	32.4
Zinc Oxide "A"	1.93	0.09	47.5	114	50.7	36.0
Zinc Oxide "B"	1.77	0.12	43.5	106	50.1	42.0
Zinc Oxide "C"	2.31	0.25	54.0	148	47.1	45.6

COMPOUND:

Smoked Sheets	100 parts
Zinc Oxide	100 parts

(1) *U. S. Patents 2,303,329 and 2,303,330*

(2) *Reg. U. S. Patent Office*

(3) Royle Tuber Conditions:

Head Temp.	75°C
Extension Temp.	55°C
Cylinder Temp.	75°C
Stock Discharge Temp.	80°C
Stock Screw Speed	30 RPM

(4) Measurements were made after chilling the stock in water.

HORSE HEAD PRODUCTS

THE NEW JERSEY ZINC COMPANY

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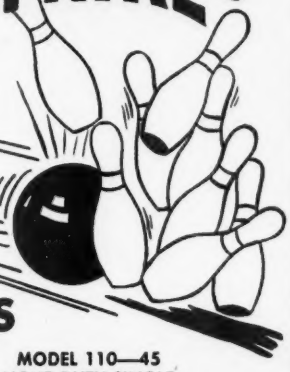
ANOTHER STRIKE!



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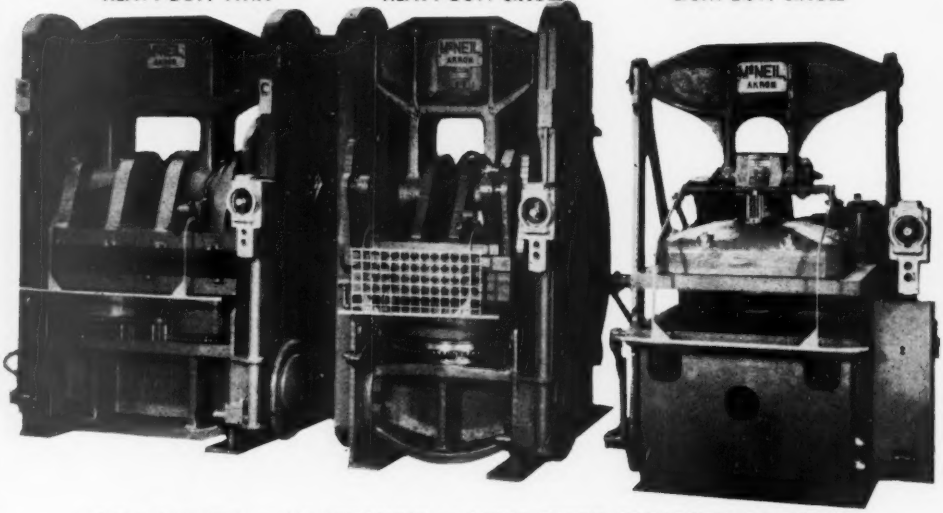

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- Two 24" x 24" drilled platens individually adjustable 1" minimum—6" maximum
- 700 pounds per square inch platen pressure
- Adjustments for mold loadings—zero to 200 tons each mold position
- Two 24" x 24" molds may be used in same or different thicknesses or one 24" x 48" mold

- 800,000 pounds total pressure
- 32" x 32" drilled steam platens
- 780 pounds per square inch platen pressure
- Adjustments of mold loadings—zero to 400 tons
- Range of mold thickness, 1" minimum to 5" maximum or 2" minimum to 6" maximum

- 110,000 pounds total pressure
- 40" x 40" drilled steel steam platens
- 70 pounds per square inch platen pressure
- Adjustment of mold loadings—zero to 55 tons
- Range of mold thickness, 4" minimum to 9" maximum

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AUSTRALIA and NEW ZEALAND—Vickers Ruwolt Proprietary, Ltd., Victoria, Australia.

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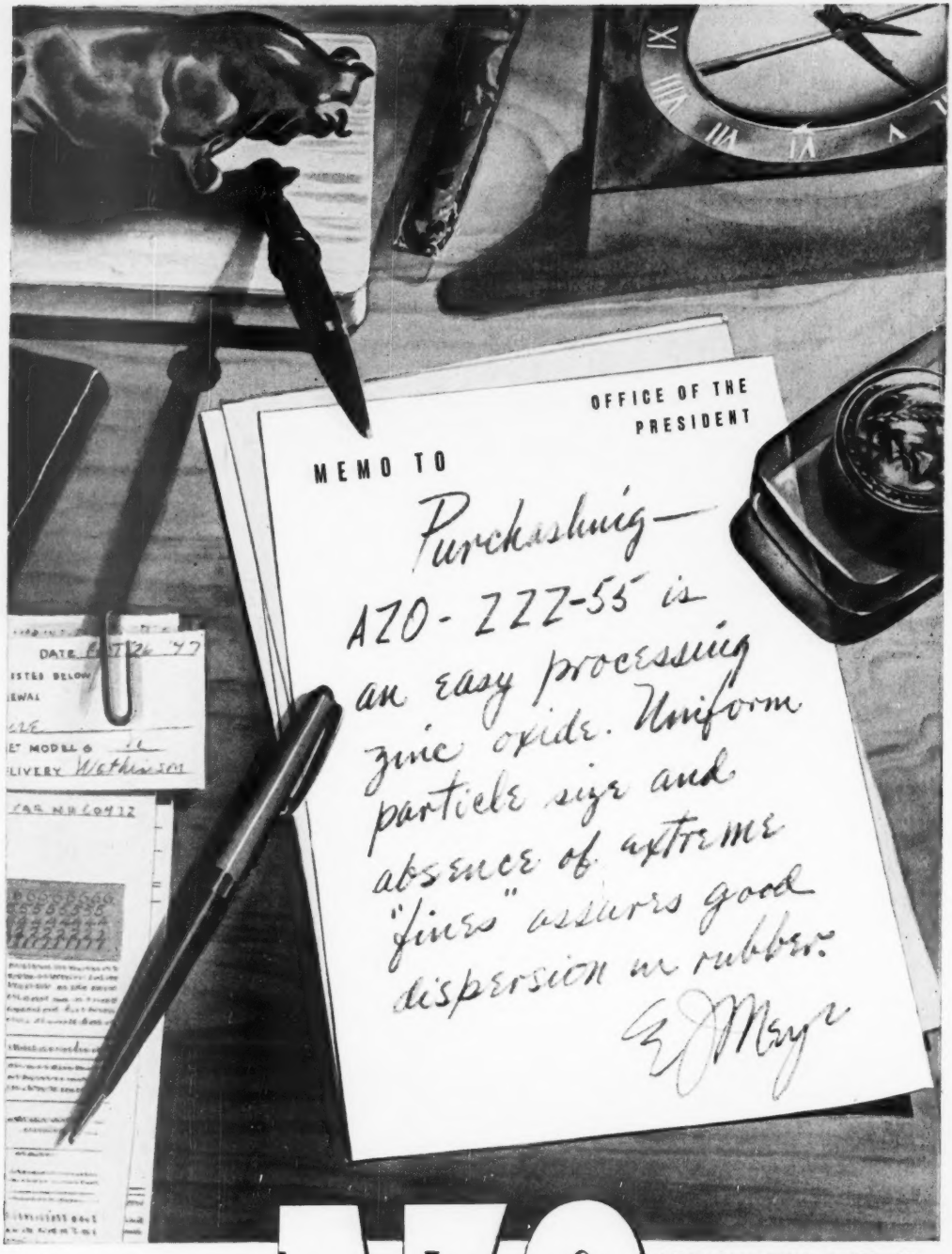

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"RECLAIMED RUBBER"

The Story of an American Raw Material

by **JOHN M. BALL**

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1. Early History
2. Mitchell and the Acid Process
3. Marks and the Alkali Process
4. Miscellaneous Reclaiming Processes
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6. Scrap Rubber
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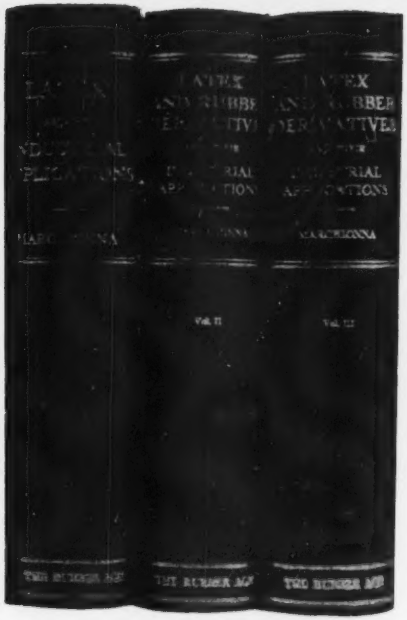

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A rubber company, manufacturing a brown rubber coated fabric, bumped into serious trouble when it was discovered that the finish aged badly on storage.

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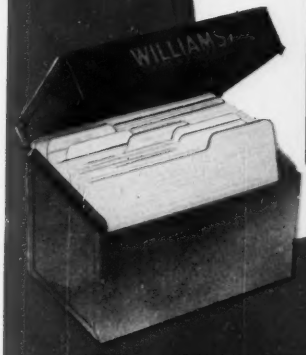

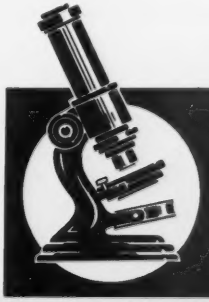

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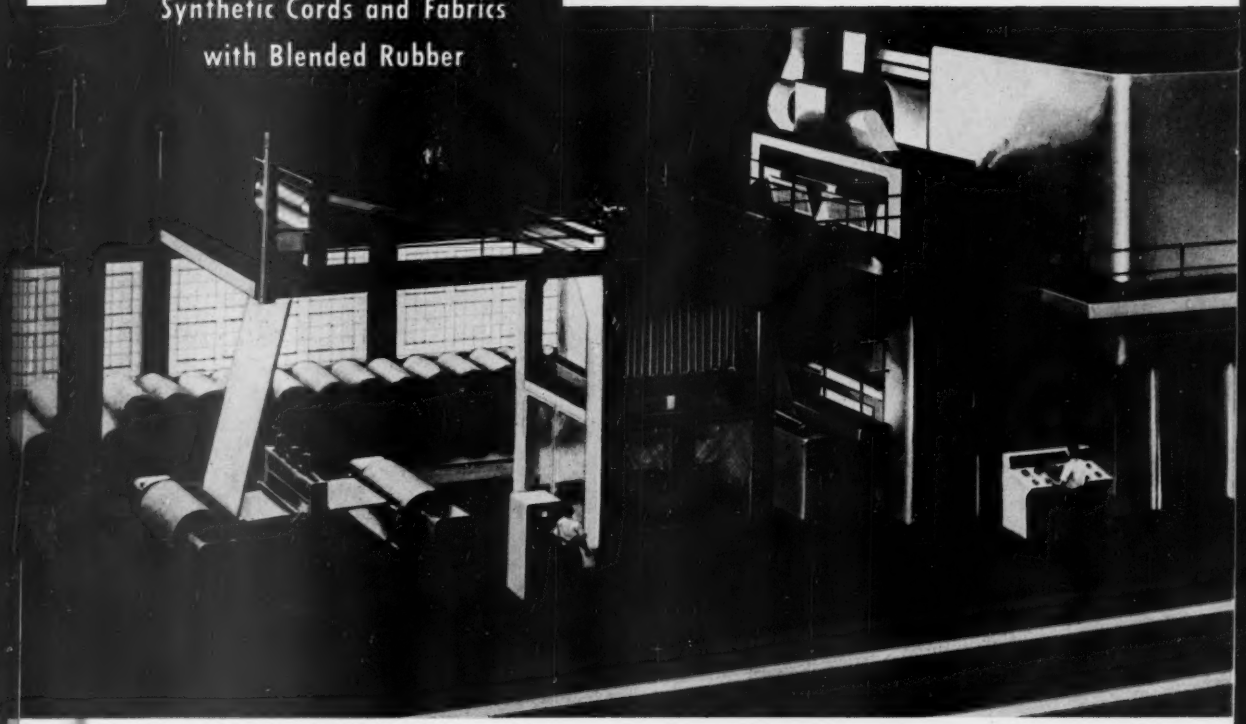

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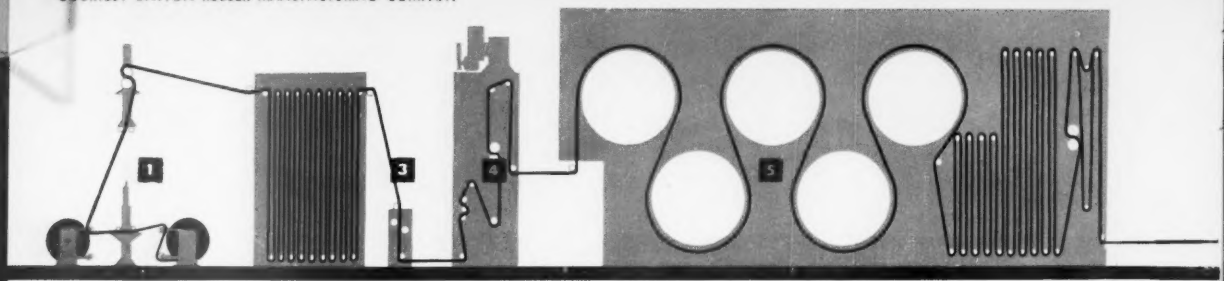

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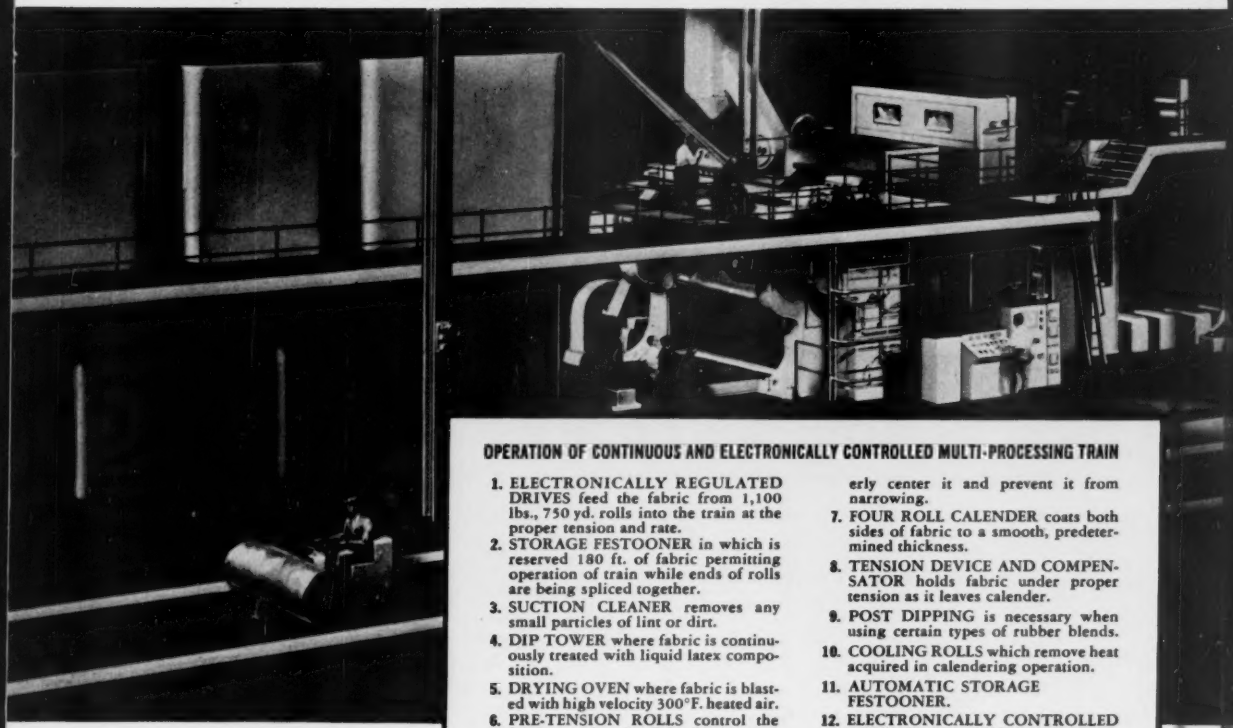

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4. DIP TOWER where fabric is continuously treated with liquid latex composition.
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7. FOUR ROLL CALENDER coats both sides of fabric to a smooth, predetermined thickness.
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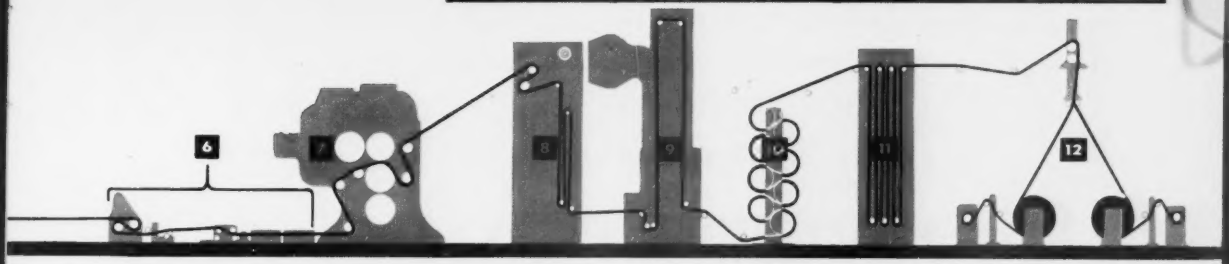
10. COOLING ROLLS which remove heat acquired in calendering operation.
11. AUTOMATIC STORAGE FESTOONER.
12. ELECTRONICALLY CONTROLLED WIND-UP MACHINES.



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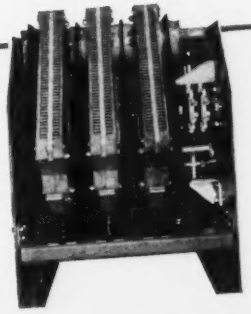
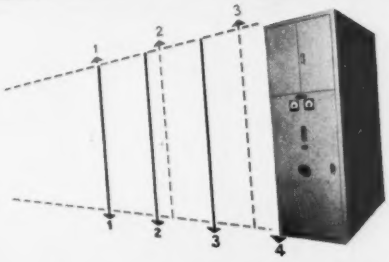
G-E developed EJ-2 fuses, providing quiet, fast-acting short-circuit protection are enclosed in a compartmented steel cabinet with the new, low-inertia air-break contactor. All the control you need for motors (even those on rapid duty cycle) is engineered, assembled, and tested in our factories to save you layout, installation, operation, and maintenance costs.

Write for more information in Bulletin GEA-5409. This includes descriptions of oil-immersed Limitamp control, reduced-voltage, two-speed, and reversing forms as well as the new full-voltage air-break controller. ***Apparatus Dept., General Electric Co., Schenectady 5, N. Y.***



MORE VOLTAGE New air-break design increases the maximum rating from 4160 to 5000 volts.

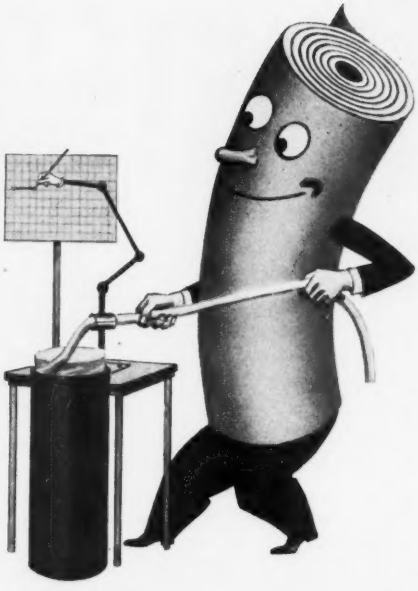


LESS SPACE Width of cabinet is reduced, so now, four air-break controllers can occupy the space formerly taken by three.

GENERAL ELECTRIC

730-12

CHECKING EVENNESS OF ROVING WITH LINEAR REGULARITY TESTER. One of a series of laboratory controls throughout production to assure fabric uniformity in all Mt. Vernon-Woodberry products.



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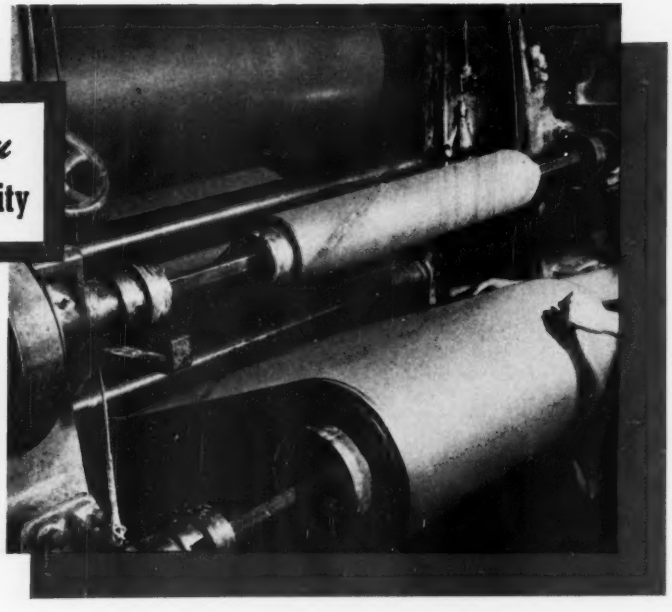

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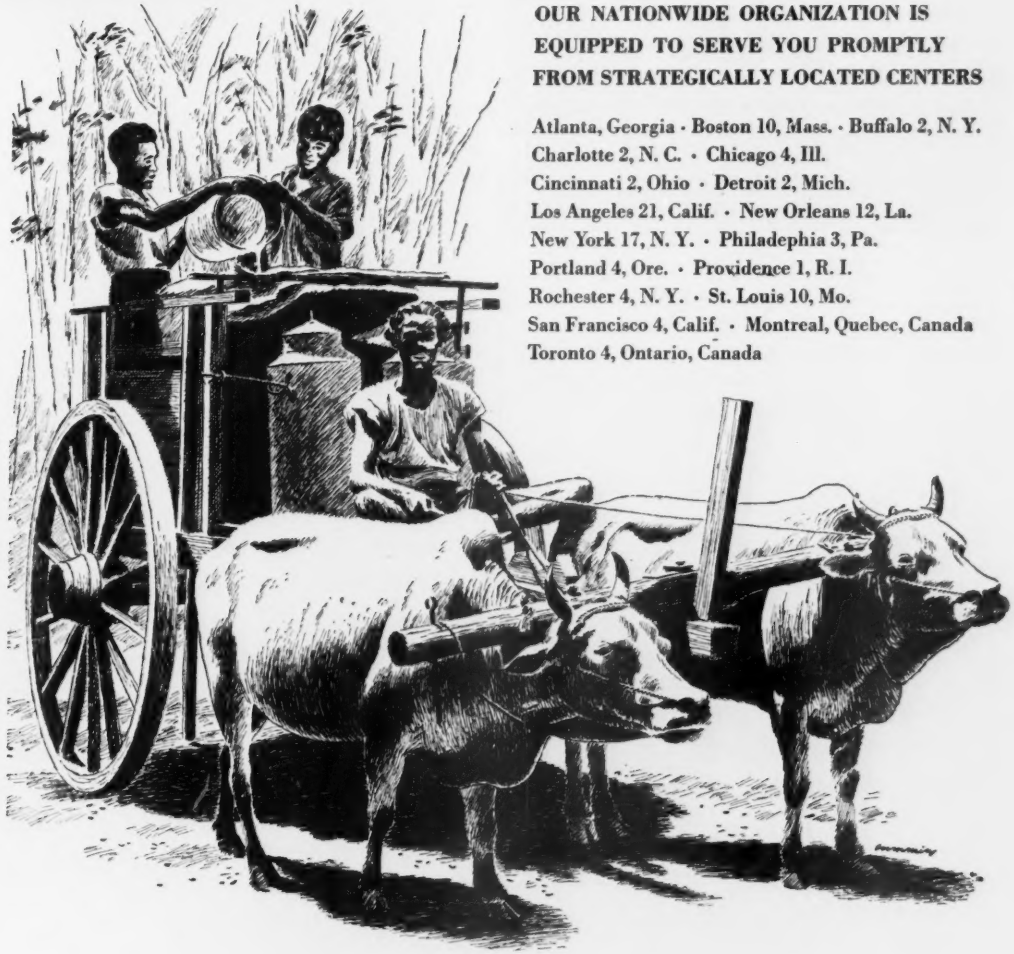

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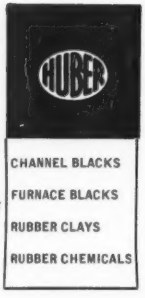

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RUBBER AGE

Vol. 66, No. 6 MARCH, 1950

The Evaluation of Flex-Life and Heat Build-Up Properties of Elastomers

By E. B. STOREY

Polymer Corporation Limited, Sarnia, Ontario, Canada

THE deficiencies of the general-purpose polymer, GR-S, in flex crack-growth and hysteresis properties became evident during the early stages of its production in North America. A very considerable effort was expended on this phase of the rubber program and it has culminated, in the past year, in the increase flex crack-growth resistance of the low-temperature elastomers. During this period the development of adequate methods for evaluating the flex life and heat build-up properties, for screening the large number of pilot plant elastomers, has given valuable aid in selecting the new products which merited a fuller examination through road tests. One of the difficulties met in this evalution arose through the fact that the flex life and heat build-up are opposed properties of a vulcanized elastomer. The compounder has developed methods for improving either one of these properties, but only at some sacrifice in the other. This situation was emphasized by Juve et al *(3)* who introduced the term "Flex-Hysteresis Balance" and, through their work, indicated the goal for an improved elastomer, i.e., a modification which would improve one of these properties with no deleterious effect on the other.

A major difficulty in this field has been, and still is, the poor reproducibility of the flex crack-growth test. There have been numerous articles devoted to this subject *(4, 5, 11)* which have indicated the importance of the type of initial cut *(5, 6)* and the test temperature *(3, 4)*, while others have outlined statistical methods of evaluating replicate test data *(7, 8)*. All these papers have pointed out the wide variation in test results which has limited this test to a rough determination of the flex crack-growth properties. The measurement of the heat build-up of vulcanizates by means of the Goodrich Flexometer *(9)*, is a much more reproducible test and there has not been any great incentive to reduce the variables introduced by differences in the state of cure of the test specimens.

In the recent paper by Juve *(3)*, the relationship between the flex life and heat build-up was presented as a relatively broad band in which the flex-hysteresis ratios for GR-S could be located, regardless of the test recipe or state of cure of the vulcanizate. While the recognition of the exact nature of the problem was a large step forward, the reproducibility of the laboratory tests was such that only a large improvement in either property could be detected in a reliable manner. This was undoubtedly a drawback when the large number of variables involved in polymerization could not be properly analyzed and it hindered the steady advance towards a solution of the problem.

The production of experimental elastomers in a pilot plant incurs a considerable expense in time and material so that the need of a reliable test procedure for limited quantities of elastomer is evident. The development of micro-test techniques for stress-strain, rebound, etc., has been outlined by Garvey *(10)*. The lack of repro-

Note: This paper was presented before the Rubber Chemistry Division, Chemical Institute of Canada, Hamilton, Ont., Canada, June 10, 1949.

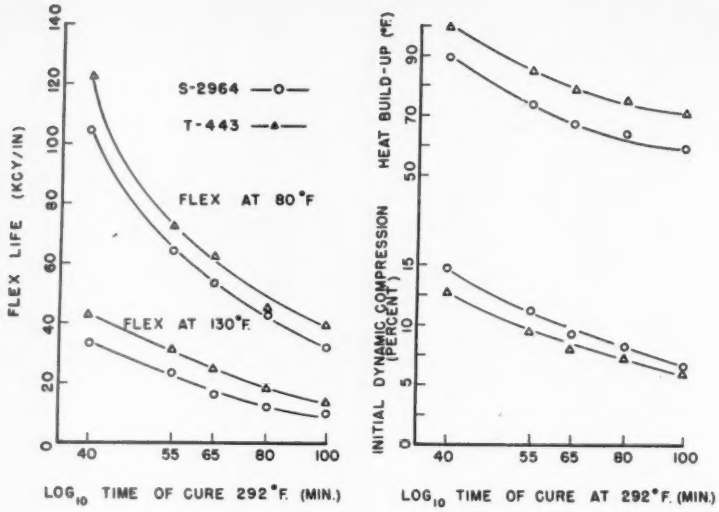

FIG. 1.

ducibility of the flex crack-growth determination has not allowed its use on a micro-scale and left no recourse except by use of replicate tests involving a relatively large quantity of material.

This deficiency has been investigated in the Research and Development Division, Polymer Corporation, Sarnia, and this paper gives an outline of the progress made in this field.

Experimental Procedure

Flex Crack-Growth Test: The flex crack-growth test was carried out with the A.S.T.M. test specimen *(1)* in a Wendes Flex Machine. This specimen, 6 by 1 by ¼-in. thick, has a 3/16-inch diameter, semi-circular groove, molded into the surface at the center which runs at right-angles to its length. The specimen was clamped in the jaws of the Wendes Flex Machine, over a distance of one inch from each end, and then bent through an angle of 180°, and back to its original position, at a rate of 400 cycles per minute. A spacing device, similar to that described by Ford *(5)*, was used to locate the specimen in the jaws in order to ensure that the center of the groove was placed midway between the jaws and at the point of maximum flexure. The jaws of the machine, capable of holding 12 specimens at one time, were located in a circulating air cabinet at a controlled ambient temperature.

An initial cut was made at the mid-point of the groove by punching a spear-shaped knife completely through the specimen. This produced a slit, 0.05-inch long in the surface of the vulcanizate, whose length was parallel to the sides of the groove. The specimen was given an initial flexing in order to start a crack growing in the vulcanizate from either end of the slit. This period was adjusted to develop a crack whose total length was between 0.15 and 0.20 inches and the rate of crack growth was measured between this point and the time at which the crack had reached a length of approximately 0.60-inch. The resistance of the vulcanizate was expressed as the "flex-life" or the number of kilocycles necessary to develop a crack one inch in length.

Heat Build-Up Test: The heat build-up was determined on a Goodrich Flexometer *(2)* using a test cylinder 0.7-inch in diameter and about one inch in height. The test cylinder was formed by piling up four discs obtained from either end of the flex strip with a 0.7-inch diameter cutter and a rotary drill press. The conditions used in the test were: Load, 143 lbs. per sq. in.; stroke, 0.175-inch; speed, 1800 cycles per min.; ambient temperature, 100°F. The temperature of the test cylinder was measured with a thermocouple situated at the base of the test cylinder, and the dynamic compression was measured each minute during the test. The heat build-up was taken as the temperature after 15 minutes running time minus the ambient temperature.

Flex Strips: The flex strips were vulcanized in a 12-cavity mold for periods of 40, 55, 65, 80 and 100 minutes

TABLE I—AVERAGE TEST DATA

Cure at 292° F. (Mins.)	Initial Dynamic Compression (%)	Flex Life at 80° F. (Kcy./in.)	Flex Life at 130° F. (Kcy./in.)	Compressed Height of Test Cylinder (inch)	Heat Build-Up (° F.)
		S-2964, Recipe No. 2			
40	14.9	106.8	34.0	0.754	89.5
55	12.6	64.6	24.3	0.826	73.5
65	9.3	53.4	16.9	0.852	67.0
80	8.3	42.4	12.9	0.867	64.0
100	6.5	31.5	10.3	0.871	59.0
		T-443, Recipe No. 2			
40	12.7	123.2	43.1	0.809	99.5
55	9.4	72.2	31.8	0.851	85.0
65	8.0	62.3	26.1	0.878	79.5
80	7.1	45.0	18.4	0.901	75.0
100	5.9	39.7	13.9	0.911	71.0

Calculated Indices of T-443 (S-2964 = 100)

Cure at 292° F. (Mins)	Flex Life at 80° F. A	Flex Life at 80° F. B	Flex Life at 130° F. A	Flex Life at 130° F. B	Heat Build-Up A	Heat Build-Up B
40	115	147	127	157	90	78
55	112	134	131	183	87	79
65	117	152	154	195	84	77
80	106	137	143	170	85	75
100	126	181	135	193	83	76
Average	115	150	138	180	86	77

A—based on equal time of cure. B—based on equal stiffness.

TABLE II—REGRESSION EQUATIONS

Elastomer	Recipe Number	Ambient Temperature (° F.)	Number of Tests	Regression Equation	Standard Deviation of Test Results
			(A) Flex Crack-Growth		
S-2964 [1]	1	130	124	FL = 3.09 IDC—13.0	3.4
X-387	1	130	35	FL = 3.10 IDC—12.2	2.4
X-387 [a]	1	130	40	FL = 2.06 IDC— 5.4	2.9
S-2964	2	80	20	FL = 9.07 IDC—31.5	7.7
S-2964	2	130	16	FL = 2.98 IDC—10.4	1.6
T-443 [2]	2	80	20	FL = 13.5 IDC—41.9	14.0
T-443	2	130	16	FL = 5.06 IDC—16.9	2.4
			(B) Heat Build-Up		
S-2964	1	100	117	T = 300.4 — 263.9 H	2.4
X-387	1	100	32	T = 300.6 — 266.0 H	1.6
X-387	1	100	36	T = 283.1 — 240.9 H	1.4
S-2964	2	100	27	T = 262.6 — 229.3 H	2.1
T-443	2	100	35	T = 314.5 — 267.1 H	1.7

Notes: FL = Flex life (kilocycles per inch crack-growth); IDC = Initial dynamic compression (%); T = Heat build-up (° F.); H = Height of compressed test piece after 15 minutes running time (inch); [1] = A GR-S polymer, production lot 2964, Sarnia; [2] = An experimental Buna S-3 type polymer; [a] = Single compounded batches.

at 292°F. Two test recipes were used in this work:

Recipe No.	1	2
Elastomer	400	400
EPC carbon black	200	200
B.R.T. No. 7	20	20
Stearic acid	—	12
Zinc oxide	20	20
Captax	6	6
Sulfur	8	8
	654	666

These compounds were prepared on a 6 by 12-inch mill according to the procedure given in the Specifications for Government Synthetic Rubbers. In most cases three batches were prepared and then blended together on a 10 by 20-inch mill for 10 minutes.

Calculations: The regression equations (Table II) were calculated, by the method of least squares, in order to determine the straight line which showed the best fit with the experimental values. The flex life was related to the percentage initial dynamic compression, measured by the Goodrich Flexometer test. The heat build-up was related to the height of the compressed test cylinder after 15 minutes running time in the Goodrich Flexometer.

Test Method

The method used in comparing the flex life and heat build-up properties of two elastomers may be illustrated by the test data obtained for a standard GR-S production lot (S-2964) and an experimental elastomer of the Buna S-3 type (T-443). The elastomers were compounded in Recipe 2, vulcanized to produce a number of flex strips and tested by the method described in the preceding section. The flex strips, produced in each mold-loading, were divided into two equal lots. The flex life of one lot was determined at an ambient temperature of 80° F., while the other lot was tested at 130°F. The average test values for each cure are given in Table I.

The flex life at 130°F. was considerably less than that at 80°F. and it is evident, as has already been stated in the literature, that the temperature must be accurately controlled during the flex crack-growth test. The flex life and the heat build-up both decreased with an increase in the time of cure. The flex life varied, not only between duplicate cures of the same compounded batch, but also between strips from the same mold-loading.

It seemed apparent that even strict control of the temperature and the time of cure were not sufficient to ensure production of the same state of cure in the various mold cavities. The initial dynamic modulus (Figure 1), which was measured during the heat build-up test, showed a similar variation between flex strips. The flex strip is bent through a definite angle (180°) by the Wendes Flex Machine and the stress produced in the groove of the specimen, therefore, will vary according to the stiffness of the vulcanizate. Since the rate of crack-growth will vary as the stress placed on the end of the crack, a comparison of the flex life of two vulcanizates should be made under conditions of equal stress.

The stiffness of a vulcanizate increases with its state of cure and it might be expected that the flex life, for each flex strip, would depend upon its state of cure. The initial dynamic modulus is a measure of the compression modulus or stiffness of the vulcanizate and should be proportional to the flex life of the vulcanizate. This relation was expressed in the form of a regression equation which is given in Table II. The observed variation in flex life of the different test strips vulcanized at the same time, then, corresponded to variations in the state of cure of the vulcanizate.

In the same way, the stiffness of the vulcanizate affected the results of the heat build-up test. The stiffer vulcanizate will suffer less deformation in the Goodrich Flexometer test, and, since a smaller amount of energy was imparted to the vulcanizate, less heat was produced through its internal friction and the increase in temperature was smaller. The comparison of the heat build-

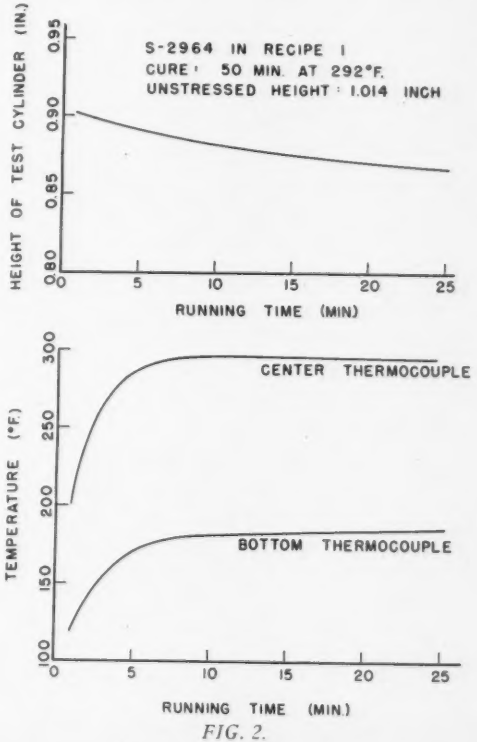

FIG. 2.

TABLE III—TYPICAL TEST DATA
(T-443, Recipe 2)

Flex Strip	Cure at 292° F. (Mins.)	Observed Values: Initial Dynamic Compression (%)	Observed Values: Flex Life at 130° F. (Kcy./in.)	Observed Values: Height of Test Cylinder (inch)	Observed Values: Heat Build-Up (° F.)	Calculated Indices (S-2964 = 100): Flex Life	Calculated Indices (S-2964 = 100): Heat Build-Up	Calculated Indices (S-2964 = 100): Ratio
A	40	11.4	37.8	0.813	99	160.6	77.0	118.8
B	40	11.3	37.1	0.830	92	159.2	78.6	118.9
C	55	9.3	29.3	0.830	93	169.3	77.7	123.5
D	55	9.1	28.5	0.859	83	170.6	79.0	124.8
E	65	7.3	21.3	0.901	75	186.8	74.8	130.8
F	65	8.8	27.3	0.879	81	172.8	75.3	124.1
G	80	7.4	21.6	0.902	75	184.6	74.4	134.5
H	80	7.1	20.4	0.893	75	188.9	77.2	133.1
I	100	6.1	16.4	0.901	72	210.2	77.9	144.1
J	100	6.1	16.4	0.931	66	210.2	74.6	142.4
					Average	181.3	76.7	129.5
				Standard	Deviation	15.4	1.7	9.0

up properties of two vulcanized elastomers, then, should be made with vulcanizates of the same stiffness or dynamic modulus.

It is difficult to mold test pieces to exactly the same dimensions. In the present instance the test piece for the heat build-up test was assembled from four discs cut from the ends of the flex strip. This method produced test pieces which had a range of 0.95 to 1.15-inch in height. The greatest strain in the vulcanizate during this test occurs at the center of the test cylinder and it is here that one would expect the greatest increase in temperature.

This point was examined by placing a thermocouple junction between the central discs and observing the temperature indicated by the center and base thermocouples during a test run. The temperature readings, plotted in Figure 2, show that the center temperature was over 100°F. higher than that at the base of the test cylinder. The reading obtained at the base of the cylinder, then, is only an indication of the maximum temperature developed at the center of the cylinder.

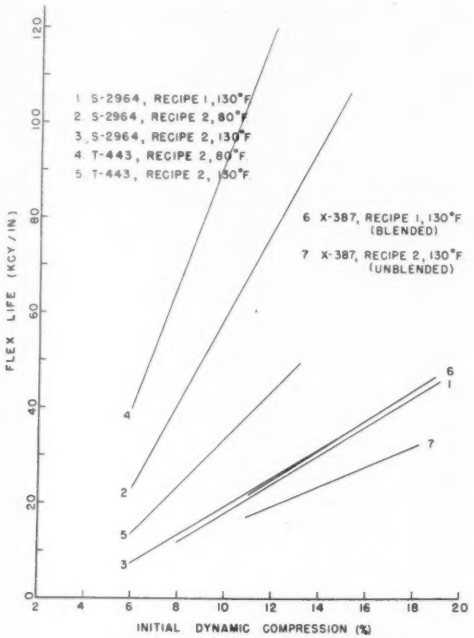

FIG. 3—Flex life regression equations.

It is evident that the heat conductivity and radiation of the vulcanizates must be assumed equal if the comparison is to be valid. The distance from the center to the base thermocouple must also be equal, for a proper comparison, since this test showed a large temperature gradient through the sample, i.e., at least 1°F. per 0.005-inch. When the test cylinder is formed by cutting discs from the flex strip it is inevitable that there will be variations in the original height of the test cylinder.

The dimension that should be controlled is that from the center to the base thermocouple at the time the heat build-up is measured, i.e., in this case after 15 minutes running time. The compressed height of the sample at this time may be measured with the Goodrich Flexometer and, when expressed as a percentage, it is the final dynamic compression. This dimension was found to vary with the state of cure of the vulcanizate in the same way as the initial dynamic compression. If the independent variable is selected as the compressed height of the test cylinder after 15 minutes running time, allowance may be made for both variations in state of cure and the height of the test cylinder by the one parameter. The relation between the heat build-up and the final compressed height was found to be a straight line whose equation is given in Table II.

The flex life and heat build-up properties of an experimental elastomer may be compared to those of a reference elastomer for vulcanizates having the same stiffness. The stiffness of any vulcanizate is a measure of its state of cure and, hence, this method does not require a very strict control of either the time or temperature of vulcanization.

In the method, the experimental elastomer is compounded in the same recipe as the reference elastomer and vulcanized for a convenient time, which approximates the best tensile cure. The flex life and heat build-up are determined by the method described above, and the corresponding values for the reference elastomer are obtained from the regression equations by using the observed initial dynamic compression, and final compressed height of the test specimen, to calculate the corresponding values for the reference elastomer. The properties of the experimental elastomer may then be expressed as indices in the following manner:

$$\text{flex life index} = \frac{\text{flex life of experimental elastomer} \times 100}{\text{calculated flex life of the reference elastomer at the same initial dynamic compression.}}$$

$$\text{heat build-up index} = \frac{\text{heat build-up of the reference elastomer at the same compressed height} \times 100}{\text{the heat build-up of the experimental elastomer}}$$

The indices obtained by this method (Table III) are relatively constant over a series of cures and one or two flex strips will give a good evaluation of the two indices. If it is desired to obtain a flex-hysteresis ratio, the sum of the indices is divided by two. A further advantage may be realized from the use of separate indices for these properties. If one property is more critical than the other, for the particular application in question, then it may be weighted accordingly in calculating the overall quality index.

Data for individual flex strips are shown in Table III for two elastomers produced under relatively different polymerization conditions and of a markedly different plasticity. The test cures ranged from under to over cures on these compounds and the indices showed no variation that might not be accounted for by the normal test error. In Table I similar data were calculated for the average values at each time of cure and the comparison of the properties of the two elastomers was based on equal cure time as well as equal stiffness. The values based on equal cure time are quite different from those calculated for vulcanizates of equal stiffness. This result might be expected as there is no reason why the rate of cure of the two elastomers should be equal.

This test procedure was carried out on 125 flex strips of five different batches of S-2964, compounded in Recipe 1, and vulcanized for periods of 40, 55, 65, 80, and 100 minutes at 292°F. The data were expressed as two regression lines whose equations are given in Table II. The deviation of each observed value from that given by the equation was used to calculate a standard deviation of the test. These values are also shown in Table II. The standard deviation of the flex crack-growth test, at an ambient temperature of 130°F., was 3.4 kilocycles per inch crack-growth, or a variation of 12.9% when based on the mean flex life for the series while that for the heat build-up test was 2.4°F., or a variation of 2.9%.

The reproducibility of the flex crack-growth test is not very good but this method, which relates the flex life with the state of cure of the vulcanizate, reduced the normal test error from about 20% to a little over 10%.

The crack grows across the groove through the successive failure of small threads of vulcanizate upon which is concentrated a large portion of the stress produced by bending the flex strip. This test is essentially different, then, from those which measure a particular property of the vulcanizate by placing the stress, or strain, on a large mass of the vulcanizate. In the flex crack-growth test, therefore, the uniformity of the structure and composition of the vulcanizate play a very large part in determining the reproducibility of the test.

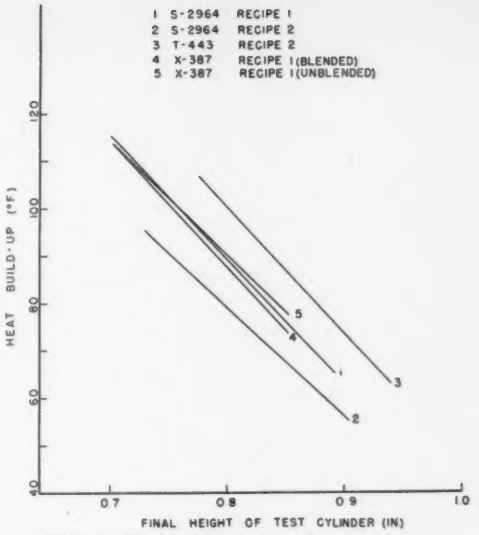

FIG. 4—Heat build-up regression equations.

The effect of a number of variables on the flex crack-growth test have been observed in developing this test method. The ambient temperature has been shown to be a large factor in the test (Table I, Figure 1). The uniformity of the dispersion of the carbon black and other compounding ingredients will also cause a large variation in the flex life. The method of compounding, used in preparing the unvulcanized stock, involved a refining step where three single batches were blended on a 10 by 20-inch mill.

The effect of this blending procedure was determined for X-387 when compounded in Recipe 1. In one test, three X-387 batches were blended on the mill and, in the other, three single batches were vulcanized without the blending procedure. The equations calculated from the test results are given in Table II and the calculated lines are shown on Figures 3 and 4. The heat build-up values were only slightly affected by the refining step, while this operation had a significant effect on the flex life. If the index for the unblended batches be denoted as 100, then, after blending, the flex life index was 124 and the heat build-up index 104. The use of refining steps to produce an improvement in flex life has been a fairly common procedure in factory operations and the improvement may be measured by this laboratory test.

The importance of a uniform dispersion of compounding ingredients, and the magnitude of the variation that may be introduced by any change in the compounding procedure, is quite evident from the test data. Tests of the properties of S-2964 in Recipes 1 and 2 showed some improvement in the heat build-up properties of Recipe 2, which differed from

TABLE IV—EFFECT OF TEST VARIABLES

Test temperature	Flex Life Index 80° F.	Flex Life Index 130° F.	Heat Build-Up Index 100° F.
Effect of ambient temperature			
(a) S-2964, recipe 2	277	100	100
(b) T-443, recipe 2	305	100	100
Effect of blending compound			
(a) blended	—	124	104
(b) not blended	—	100	100
Effect of test recipe			
(a) recipe 1	—	100	100
(b) recipe 2	—	109	113

Recipe 1 only by the addition of 3 parts of stearic acid per 100 parts of elastomer.

The addition of stearic acid might be expected to improve the dispersion of the carbon black and, thus, the flex life of the vulcanizate. The improvment that was found in the flex life, however, was scarcely significant. A variation in stearic acid content may occur between experimental elastomers produced in a pilot plant, although not to the extent of three parts per hundred of elastomer. This factor, however, should not be neglected in comparing the properties of two elastomers.

The ambient temperature of the flex crack-growth test produced a slight change in the relative flex life indices (Table IV) over the range of 80° to 130°F. It might be expected that the comparative rating of two elastomers would vary according to the test temperature and careful consideration should be given that the most appropriate temperature is selected for such a comparison.

This method of comparing the flex life properties of various elastomers will give a constant value, regardless of the state of cure of the vulcanizate, only if all the calculated regression lines have a common point of intersection at zero flex life. The same requirement must be met by the relations between the heat build-up and the height of the sample after 15 minutes running time. The point of intersection of each regression line with the abscissa axis is given in Table V. These data further reflect the relative accuracy of the two tests and the sensitivity of the method to recipe variations. It would appear that the point of intersection of the regression lines, in each test, would be identical for different elastomers, providing that they were compounded in the same recipe and that the milling procedure produced an equivalent degree of dispersion of the ingredients.

Summary

A method has been developed whereby the separate indices may be obtained for the flex life and heat build-up properties of elastomers. These indices are independent of the state of cure but dependent upon the test recipe and the dispersion of the compounding ingredients. The method may be used to examine the effect of polymerization variables, compounding ingredients and procedures, or ambient temperature, on these two properties.

TABLE V—POINT OF INTERSECTION OF REGRESSION LINES

(A) Flex crack-growth

Elastomers	Recipe	Ambient Temperature (° F.)	Initial Dynamic Compression (%) (when calculated flex life is zero)
S-2964	1	130	4.19
X-387	1	130	3.95
X-387 [a]	1	130	2.62
S-2964	2	80	3.47
S-2964	2	130	3.49
T-443	2	80	3.11
T-443	2	130	3.36

(B) Heat build-up

Elastomers	Recipe	Ambient Temperature (° F.)	Height after 15 minutes Running Time (inch) (when calculated heat build-up is zero)
S-2964	1	100	1.14
X-387	1	100	1.13
X-387 [a]	1	100	1.18
S-2964	2	100	1.15
T-443	2	100	1.18

[a] Single compounded batches, all others are three blended batches.

ACKNOWLEDGMENTS

The author wishes to acknowledge the support of the National Research Council, Ottawa, which made this work possible. The assistance and valid criticisms of Dr. N. R. Legge and Mr. S. C. Einhorn are greatly appreciated.

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Pressure Control on Laboratory Presses

IN CERTAIN operations at the Frederick S. Bacon Laboratories in Watertown, Mass., it has been necessary to hold a small constant pressure (300 pounds total) over a long period involving a heating and cooling cycle. Even with constant careful control, the operator had difficulty maintaining such a pressure with plus or minus 100 pounds on the Preco Press (total capacity, 40,000 pounds). The press is equipped with an auxiliary gauge reading to 750 lbs. total pressure.

It was found that by replacing the ram extension of the press with a heavy helical shock absorber spring (3-inch diameter by 6 inches long, requiring 1500 lbs. for complete compression) it was possible to hold a pressure of 300 pounds, plus or minus 10 pounds, with only occasional attention by the operator. The spring expands or contracts with small changes in the press dimensions due to its expansion or contraction during the heating and cooling cycles without changing the pressure very markedly. Previously, relatively small temperature changes in the press platens caused sufficient changes in the oil temperature or press dimensions to change the pressure by as much as 100 percent.

The Effect of Atmospheric Ozone on Tires during Storage

By A. H. NELLEN, WM. B. DUNLAP, Jr., C. J. GLASER, Jr., and R. A. LANDES

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VULCANIZED rubber articles are subject to deterioration by cracking or "checking" when stored or used under conditions of stress. Industry-wide research has resulted in the conclusion that this cracking is caused by ozone in the air, which apparently attacks the double bonds in the natural or synthetic rubber. To briefly summarize the literature, ozone in very minute concentration will produce cracks in vulcanized rubber with the axis of the crack perpendicular to the direction of stress. The size and number of cracks formed depend on the amount of stress, i.e., with no stress there will be no cracking; at very low stresses, the cracks will be few and deep, and as the stress is increased, the cracks will be more numerous but shallower.

Williams *(1)* was probably the first to point out positively the effect of ozone on rubber. Van Rossem and Talen *(2)* have shown that the presence of light is not necessary to the formation of such cracks and that sunlight may retard cracking through the formation of an oxidized surface skim. Crabtree and Kemp *(3)* have described a laboratory ozone generator and have discussed means by which ozone attack may be prevented. Newton *(4)* has presented an admirable discussion of the problem including some work on the variability of ozone concentration with climatic conditions. Crabtree and Kemp have also recognized the variation of normal ozone content in the atmosphere and a chart was presented showing the variation of ozone content for a one-year period at Murray Hill, N. J.

There are two basic methods of protection against ozone attack: (a) The incorporation of a material in the rubber compound which will bloom to the surface and present a barrier to ozone attack, (b) External protection of the article by a covering such as paper wrapping or an ozone resistant surface treatment.

For pneumatic tires, there is a serious drawback to protection by a bloom or by a surface treatment in the form of a paint. These methods are usually adequate for protecting tires during storage, but are very harmful after the tires get into service because fractures in the protective bloom or coating will localize ozone attack, resulting in extremely deep cracking to the cord plies at the points of rupture.

Paper wrapping of tires affords adequate protection against ozone attack during storage without the risk of this harmful effect after the tires get into service. Tire wrapping to be 100% effective must, of course, completely and tightly cover the tire. However, experience has shown that even if the wrapping becomes loose or partially removed, the presence of the paper itself will retard ozone attack. Ewell *(5)* has shown that untreated cardboard will readily absorb ozone and do it preferentially to rubber. The same also appears true of all cellulose materials.

Prior to World War II, most tire companies paper-wrapped their product for replacement sales. Due to paper and manpower shortage during the war, this practice was discontinued by government order. Following the cessation of hostilities, the acute tire shortage prevented accumulations of tires in warehouses, and it was not until production of tires caught up with demand that tire storage again became a problem. The Lee Rubber & Tire Corporation, recognizing this change in trend, resumed the practice of wrapping all 4 and 6 ply tires over a year ago. Due to the stiffer, more rigid construction, larger truck tire treads and sidewalls are not subject to strains in storage, and consequently these tires do not require wrapping.

As a part of its research program on this problem, the Lee laboratory has made a nationwide survey to determine the degree of ozone attack under various storage and climatic conditions. This survey was made on samples exposed in warehouses and exposed directly to the atmosphere outdoors. A preliminary test made at Conshohocken indicated building construction was an important factor in ozone attack. It was found that samples exposed in a building of all metal construction checked more severely than samples exposed in a building of concrete block construction with steel beams. A part of the samples sent out were accordingly placed

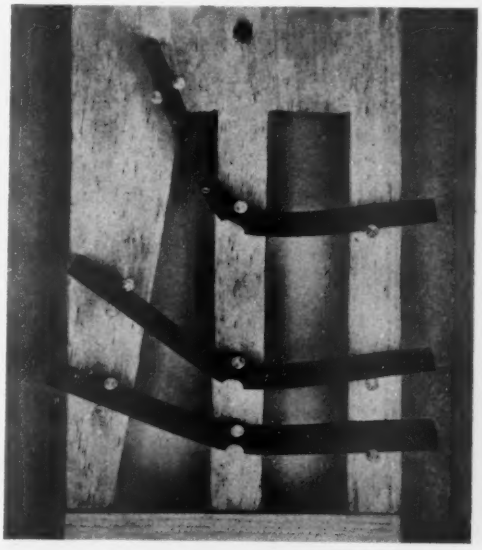

FIG. 1—Test pieces bent at various angles.

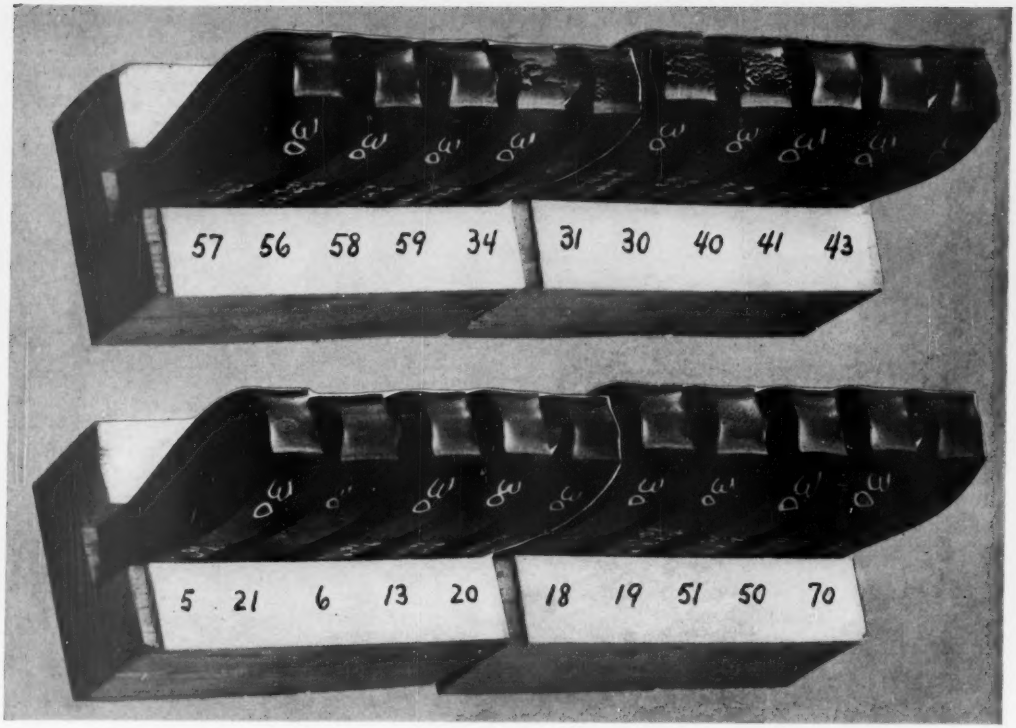

FIG. 2—Degree of severity found in some of the test locations (see Table I).

in buildings of several types of construction to verify the preliminary observation.

The samples used for the test were cured from a carefully blended batch of factory mixed tread stock. The rubber used was X-478 "cold rubber" with 50 PHR of HAF black reinforcement. The samples used were cut from conventional DeMattia flexing slabs. The dimensions were 6.0" x 0.50" x 0.25," with the groove bisecting the test piece. Three pieces were mounted on a shellacked wooden board so that one was bent through an angle of 15°, the next through an angle of 30°, and the third through an angle of 60°, to reproduce in the groove of the test piece varying strains which might be encountered in the base of the groove of a tire under variable storage conditions (see Figure 1).

The average exposure time of the samples was 45 days. After exposure, the samples were rated for degree by comparison with a set of standards exposed in a laboratory ozonizer.

The laboratory ozonizer is a cabinet to which ozonized air is supplied in the following manner: Compressed air is passed through flake caustic and silica gel drying tubes arranged in series. It is then passed through a "flowrater" at the rate of flow of 3000 ML per minute and then into a sealed bell-jar containing the ozone generator. The ozone generator is an Electroaire Model S. The ozonized air from the bell-jar is then passed into the cabinet where even distribution is effected by an Electrolux sweeper-type fan. The incoming air displaces the partially depleted ozonized air through a port in the top of the cabinet and the space around the fan shaft. The ozone concentration used during these tests was approximately 4.4 ± 0.2 PPM.

The set of standards was exposed over a range of 8 hours in 30 minute increments. The samples returned from each location were compared to the standard set. The rating assigned was a numerical rating equal to the

TABLE I—SPECIFIC RATINGS

Sample No.	Location	Rating
5	New York, N. Y.	<30
21	Conshohocken, Pa.	<30
6	Washington, D. C.	30
13	Atlanta, Ga.	<30
20	Boston, Mass.	150
18	New Orleans, La.	115
19	Dallas, Tex.	150
51	Indianapolis, Ind.	50
50	Chicago, Ill.	120
70	Dayton, Ohio	90
57	Wichita, Kan.	30
56	Minneapolis, Minn.	75
58	Omaha, Neb.	60
59	Denver, Colo.	360
34	Long Beach, Cal.	330
31	Santa Monica, Cal.	420
30	Los Angeles, Cal.	360
40	Portland, Ore.	30
41	Seattle, Wash.	<30
43	Yakima, Wash.	30

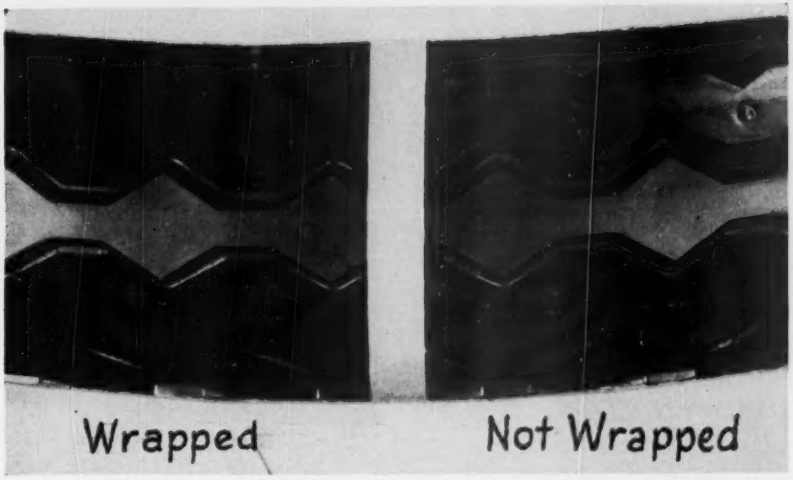

FIG. 3—Effectiveness of paper wrapping. Note severe checking in the tread groove of the unprotected portion.

total exposure in minutes of the standard with which it compared, i.e., a location which compared to the one hour laboratory exposure was rated 60.

A total of 87 test boards were sent out representing 55 locations throughout the United States. The boards were so placed that they gave a representative cross-section of the country.

Since the main purpose was to check storage warehouse conditions, most of the sample boards were exposed indoors under normal tire storage conditions. Boards exposed to the outdoor atmosphere were severely cracked in all cases, the minimum rating being 300. This is further evidence of the fact that unprotected tires stored or displayed outdoors under any tension will suffer deterioration under all climatic conditions.

Sample boards exposed in tire warehouses varied from a rating of less than 30 where cracking was visible only under magnification to a maximum of 420. The major reason for this extreme variation is varying ozone concentration in the atmosphere. The Southern California and Denver areas represent the worst conditions in the country. The North Pacific coast and the midwest show considerably less ozone with the lowest average in the Middle Atlantic states. The Boston area, the Gulf Coast and Texas are fairly high in ozone.

Specific ratings are listed in Table I of certain locations representative of various sections of the country. All of these samples were exposed in tire warehouses.

It was also found that factors other than ozone concentration had a very important bearing on degree of cracking. These are the type of building construction and the ventilation, both of which have a very definite influence on the speed and degree of cracking. With only two exceptions, samples exposed in buildings of galvanized iron construction were cracked more severely than samples exposed in buildings of masonry construction in the same location. There was not sufficient knowledge of the actual conditions in one of these exceptions to draw a conclusion. The other exception to this was a metal construction carpenter's shed and, in this case, undoubtedly the volume of wood, sawdust and shavings present absorbed a considerable portion of the ozone.

Both Newton and Talen have shown that air velocity is a factor in ozone attack. Both have reported greatly increased cracking on windy days as compared to calm, still air. It may be deduced from this that loosely constructed, drafty buildings would be more conducive to ozone attack than more solidly built masonry buildings.

A notable example of one of the poorest warehousing conditions was in the Southern California area where the building is of galvanized iron construction with large doors at either end to permit the passage of trucks.

It is entirely possible for tires stored in a section of the country where ozone content is fairly low to check severely, whereas tires stored in sections of known high concentration will be reasonably well protected simply because of the type warehouse. Table II gives a comparison of the effect of metal construction.

Figure 2 graphically portrays the degree of severity found in some of the locations listed in Table I. The test samples shown in the photograph are the 30° bend only.

The effectiveness of paper wrapping is demonstrated very clearly in Figure 3, which shows a tire section

TABLE II—COMPARISON OF THE EFFECT OF METAL CONSTRUCTION

Location	Rating	
	Metal Constr.	Masonry Constr.
Conshohocken, Pa.	180	<30
Mansfield, Ohio	210	70
Denver, Col.	300	150
Des Moines, Iowa	200	100
Chicago, Ill.	210	210
Baton Rouge, La.	300	270
Natchez, Miss.	180	210
Scottsville, Ky.	150	60

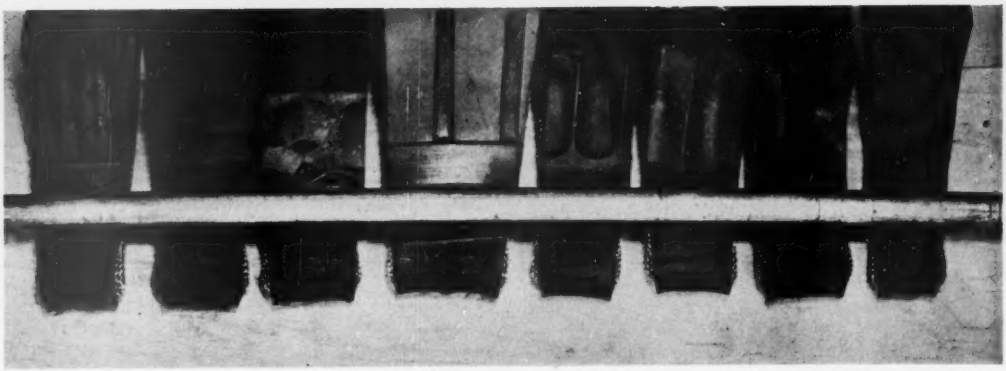

FIG. 4—Comparison of various tire sections which have been exposed to ozone attack.

half of which was wrapped with 90# basis weight kraft tire wrap, water finished one side. The other half of the section was unprotected. This section was ozonized for 12 hours at the same concentration used in preparing the standard samples. These results confirm previous tests on tires partially wrapped and exposed to the atmosphere. The photograph clearly shows severe checking in the unprotected portion and the complete absence of checking in the wrapped portion.

The existing conditions of storage found in this survey reaffirms the need which prompted this company over a year ago to resume wrapping. Wrapping will overcome these variables of ozone concentration and warehouse conditions and in effect makes each tire its own ideal warehouse.

Figure 4 shows a comparison of Lee and competitive tire sections which have been exposed to ozone attack to further demonstrate the susceptibility of all makes of tires to this form of deterioration.

In summary, it may be said that the degree of deterioration of tires in storage from ozone attack will vary to a great extent in different sections of the country. The type of construction and ventilation of the warehouse has a very important bearing on the degree of checking. Unprotected tires stored or displayed in the open under any tension will become cracked, regardless of location. Paper wrapping of tires affords adequate protection against ozone attack and eliminates harmful effects in service usually found with protective materials mixed into the compounds or with protective paints. Considerable research must be planned in order to find a compounding material which will reduce or prevent dynamic as well as static ozone cracking.

ACKNOWLEDGMENT

The authors wish to thank the following companies for their cooperation in exposing the test boards under varying conditions: Signal Oil Co., Phillips Petroleum Co., Gates Rubber Co., Armstrong Tire & Rubber Co., Mansfield Tire & Rubber Co., Dayton Rubber Co., Inland Rubber Corp., and Copolymer Corp.

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Rubber Manufacturing Activities in Various Countries

DATA on the rubber manufacturing activities of various foreign countries, as recently reported by the U. S. Department of Commerce, is presented below:

Austria: Production of rubber footwear in Austria in the first half of 1949 amounted to 886,336 pairs, more than double the output of 363,336 pairs in the first half of 1948, and approached the total of 974,873 pairs for the full year. By classes, production rose from 171,978 pairs of shoes with rubber soles in the first half of 1948 to 368,435 pairs in the first half of 1949; rubber sneakers, from 63,550 pairs to 177,157 pairs; rubber overshoes, from 32,642 pairs to 102,223 pairs; and rubber boots, from 94,166 pairs to 238,521 pairs. The output of rubber boots and of shoes with rubber soles in the first half of 1949 exceeded production for the full year 1948.

New Zealand: Production of tires in New Zealand in the first half of 1949 was estimated at 55,000 of which 40,000 were for passenger cars and 15,000 for trucks and busses. Tubes were produced for about 70 percent of the number of tires. The tire market was steady in the first half-year. Inventories of one large producing company were reported to be more than sufficient for market requirements. The excessively heavy postwar demand was satisfied in 1948.

Trade organizations have complained about the regulation, effective at the beginning of 1949, that imported car and truck chassis be fitted with domestically produced tires as original equipment, on the ground that although the cost of such tires for replacement is not much higher than that of imported tires, the cost for original equipment is substantially higher. Truck operators state that as high-pressure tires are not made in New Zealand, they must sacrifice loading capacity by using low-pressure tires of the same size or buy larger low-pressure tires at higher costs.

Laboratory Experiments on Extending Cold Rubber Tread Stocks with Furnace Black and Unsaturated Petroleum Plasticizer

By F. M. McMILLAN, D. E. WINKLER, and M. D. ANDERSON

Shell Development Company, Emeryville, California

SEVERAL years ago an extensive study was made of the effects of extending regular GR-S tread stocks with combinations of carbon black and an unsaturated petroleum plasticizer, culminating in a series of road tests on extended tread stocks chosen on the basis of the laboratory work.* The results demonstrated that with the proper type and proportions of carbon and plasticizer, it is possible to increase the total loading of a GR-S tread stock to a sufficient extent to significantly improve processing characteristics without adversely affecting physical properties or resistance to road wear.

For successful extending action of this type, it is of course necessary to choose a reinforcing agent and plasticizer which have approximately equal and opposite effects on the stock, so that they will largely counteract each other. The extent to which this is achieved when using EPC black as the reinforcing agent and Dutrex 6 as the plasticizer in a regular GR-S tread stock is indicated qualitatively in Table I, which shows the general effects of adding increasing proportions of the two components. Up to fairly high loadings, the only marked net effects are a reduction in the nerve of the uncured stock and a slight increase in tear strength.

When low-temperature polymerized GR-S, or "cold rubber," became available in substantial quantities and its superior qualities as a tread rubber were conclusively demonstrated, it became of interest to determine whether the same principles of extending with carbon and unsaturated petroleum plasticizer that were worked out for regular GR-S could be applied successfully to the new type of polymer.

Initially, there was a natural tendency to regard cold rubber as a "super quality" product with which one could scarcely hope to tamper or to dilute with more than the minimum amounts of compounding ingredients without risking the loss of its unique and outstanding qualities. On the other hand, when it is considered that those qualities are not exhibited by the rubber alone (e.g., in a gum stock) but are developed only when substantial amounts of reinforcing agents and other auxiliary ingredients are added, there is no real reason to believe that a properly balanced extending combination should not maintain unimpaired properties here as well as in the case of regular GR-S.

Compounding studies were therefore carried out to determine the proper ratio of added carbon to added plasticizer for this system, using Dutrex 6 as the plasticizer and HAF black as the reinforcing agent, since the latter has been shown to be an outstanding reinforcing agent for this type of polymer.

Starting from a basic cold rubber tread stock recipe containing 45 parts of HAF black and 5 parts of Dutrex 6, the ratio of added carbon to added softener that would give constant modulus with increasing total loading was worked out by a series of successive approximations, and the optimum ratio was found to be 0.94:1. This is in interesting contrast to the ratios of 1.4:1 for an EPC black - Dutrex 6 combination and 1.6:1 for an HMF black - Dutrex 6 combination, both in regular GR-S.

Based on this ratio, a series of compounds was prepared covering the range from 40.3 to 65 parts of carbon and from 0 to 26.3 parts of plasticizer, with proportions determined according to the equation:

$$C = 40.3 + 0.94\ P$$

where

C = carbon loading and

P = plasticizer loading, both in parts per hundred of rubber.

The recipes for the entire series are shown in Table II. Because of the slight retarding effect of Dutrex 6,

* McMillan, Wheeler and Blackburn, *Rubber Age (N.Y.)*, Vol. 61, p. 555 (1947).

TABLE I—QUALITATIVE EFFECTS OF ADDING EPC BLACK AND DUTREX 6 TO A REGULAR GR-S TREAD STOCK

Property	Effect of Carbon	Effect of Dutrex	Net Effect
Mooney Plasticity	Increase	Decrease	.....
Batch Temperature	Increase	Decrease	.....
Power Consumption	Increase	Decrease	.....
Nerve	Decrease	.....	Decrease
Tensile	Increase	Decrease	.....
Elongation	Decrease	Increase	.....
Modulus	Increase	Decrease	.....
Tear Strength	Increase	Sl. Decr.	Sl. Incr.
Hardness	Increase	Decrease	.....
Hysteresis	Increase	Decrease	.....
Abrasion Resistance	Increase	Decrease	.....
Cost	Decrease	Decrease	Decrease

TABLE II—RECIPES

X-485 GR-S	100	100	100	100	100	100
HAF black	40.3	45	50	55	60	65
Dutrex 6	0	5	10.3	15.7	21.0	26.3
Phenyl-β-naphthylamine	1.2	1.2	1.2	1.2	1.2	1.2
Stearic acid	2.0	2.0	2.0	2.0	2.0	2.0
Zinc oxide	5.0	5.0	5.0	5.0	5.0	5.0
N-cyclohexyl-2-benzothiazole-sulfenamide ...	1.25	1.25	1.25	1.25	1.25	1.25
Sulfur	1.67	1.75	1.83	1.92	2.00	2.08

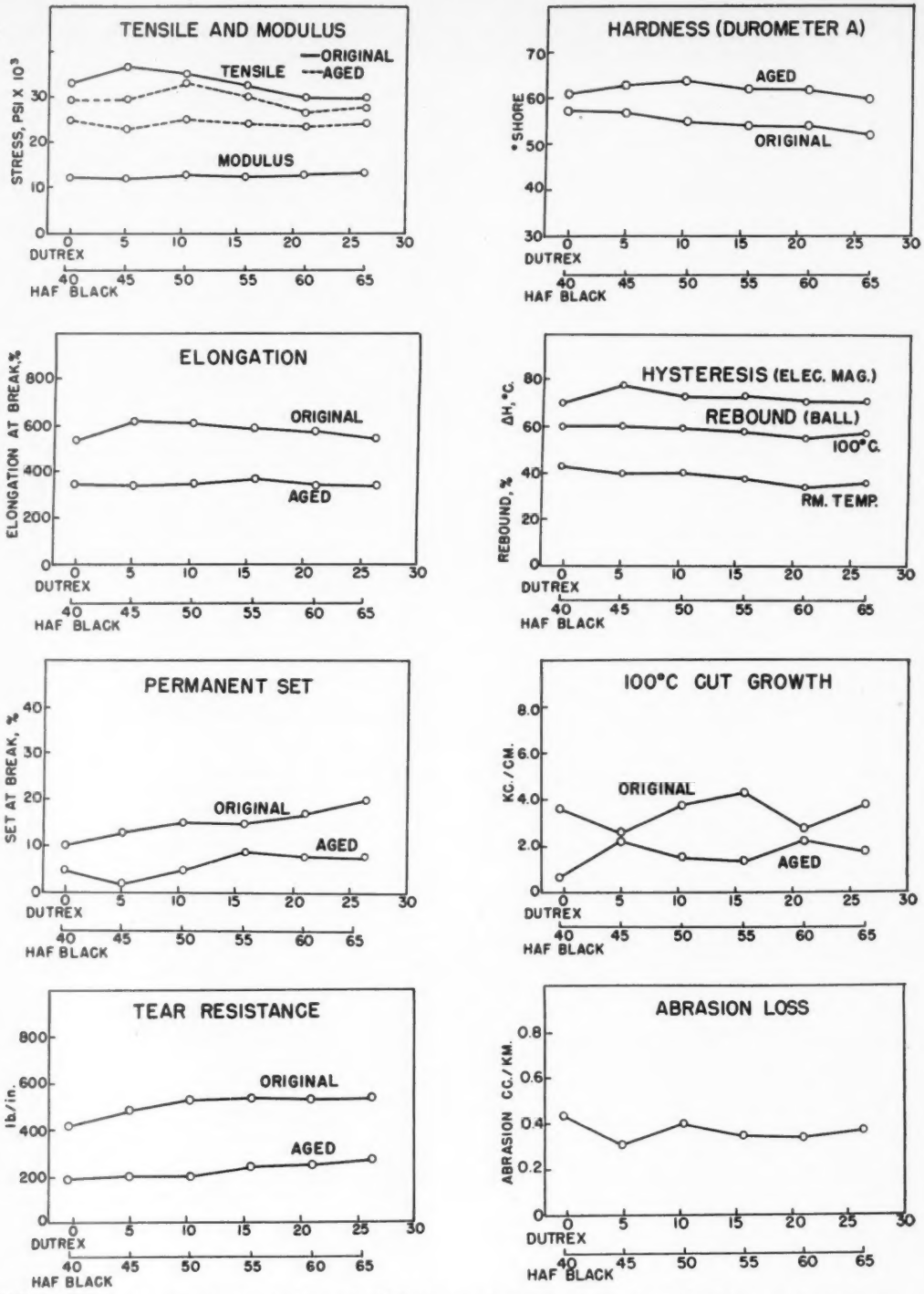
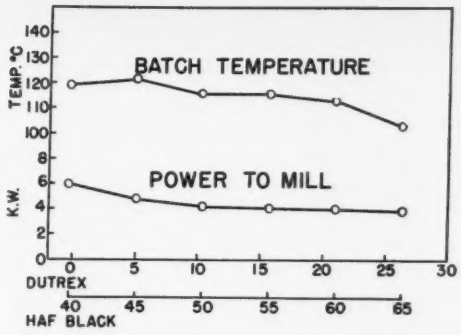


FIG. 1—Effects of increasing proportions of HAF black and unsaturated petroleum plasticizer on physical properties of a "cold rubber" tread stock.



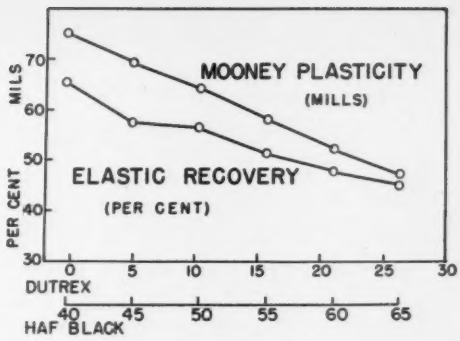


FIG. 2—Effects of increasing proportions of HAF black and unsaturated petroleum plasticizer on processing characteristics of a "cold rubber" tread stock.

the sulfur loading was increased somewhat as the total loading increased. This resulted in substantially identical curing rates for all of the compounds in this series, and after examination of a range of five cures for each stock, the 45-minute cure at 145°C. (293°F.) was chosen for the detailed comparisons. The properties of the vulcanized stocks are plotted in Figure 1 as a function of total loading to reveal any trends in physical properties.

The effects of increased total loading may be summarized as follows:

1. As intended, the modulus remained constant over the entire range of loadings. Elongation was also substantially constant.
2. Tensile strength decreased slightly at the highest loadings, but not sufficiently to be of much significance. Permanent set showed a moderate increase.
3. Durometer hardness decreased slightly.
4. Rebound resilience showed no significant decrease even at the highest loadings and hysteresis was actually slightly reduced. This result, which is more favorable than was found with EPC black in regular GR-S, may be attributed to two factors: (a) HAF black has less effect on resilience than EPC black; and (b) a higher ratio of plasticizer to carbon was used in the present series.
5. Tear strength and cut-growth resistance showed no significant trend. (This again contrasts with the regular GR-S-EPC-black series, where a definite improvement in tear and cut-growth was observed.)
6. Abrasion resistance was equal or superior to that of the control. This is of particular interest because high abrasion resistance is the chief advantage of the low-temperature polymer.

It may therefore be concluded that the use of this extender combination produced no marked changes in any of the properties of the vulcanizate that are important to tire performance. It is then of interest to observe what changes were produced in the uncured stocks. These data are presented in Figure 2, and may be summarized as follows:

1. There was a linear reduction in Mooney plasticity with increased total loading. This is a desirable trend, since the polymer itself is a relatively tough, high-Mooney rubber. The small spread between raw Mooney and compounded Mooney which has been cited as a disadvantage of the low-temperature polymer is greatly increased in the extended stocks and brought into the same range as regular GR-S.
2. In keeping with the reduced Mooney plasticity, the power requirement on the mill was reduced. Batch temperature (final) also showed a downward trend.
3. Elastic recovery (nerve) was markedly reduced, indicative of smoother processing and improved extrusion characteristics. In confirmation of this, Figure 3 compares photographs of stocks extruded through the same dies on a laboratory tuber. The extended stock has a smoother appearance and a considerably smaller cross-section than the conventional stock.

The improved processing characteristics noted here are of even greater significance with cold rubber than with regular GR-S, since difficult processing has been the only serious disadvantage of the low-temperature polymer.

In compounding stocks of this type containing relatively high proportions of carbon and plasticizer, it is recommended that these ingredients be added alternately in several portions; e.g., ⅓ of the carbon, then ⅓ of the softener, another ⅓ of the carbon, and so on. Alternatively, the total mixing time can be markedly reduced by premixing the carbon black and the plasticizer, a procedure which can not be readily applied with EPC black but which appears quite practical in the case of furnace carbons.

As an example, when the compound containing 60

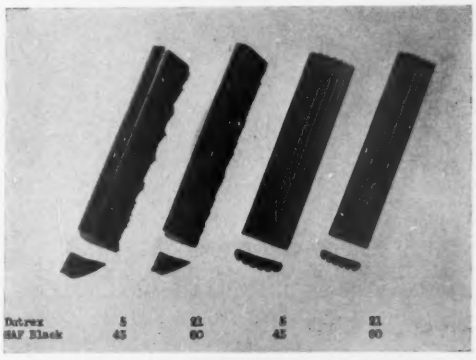


FIG. 3—Extruded sections of conventional and extended "cold rubber" tread stocks.

parts of carbon and 21 parts of Dutrex 6 was compounded on a 6-inch laboratory mill using premixed carbon and plasticizer, the total incorporation time for the carbon and softener was only 4½ minutes, compared to 24 minutes when this same stock was compounded with separate addition of carbon and softener. The physical properties of the vulcanizates were substantially identical in the two cases.

Test Methods

The following test procedures were used in obtaining the data reported in this paper:

Plasticity: Mooney plasticity at 100°C, determined with the standard (1½") rotor, using a warm-up time of 1½ minutes and reading after 1 minute's running.

Elastic Recovery: Determined by sheeting the compounded stock through the mill at a fixed setting and measuring the area of the sheet after resting overnight. The theoretical area for zero recovery is calculated and the per cent elastic recovery is given by the expression:

$$\frac{\text{Theoretical Area} - \text{Measured Area}}{\text{Theoretical Area}}$$

Tensile, Elongation, and Modulus: ASTM Method D412-41 (Die C).

Permanent Set: Set at break, determined by measuring broken tensile test pieces.

Tear Strength: ASTM Method D624-41T (Die B).

Hardness: Shore "A" Durometer.

Rebound: Per cent rebound of a ⅜ inch diameter steel ball, dropped from a height of 60 cm. Measured at room temperature and at 100°C.

Hysteresis: Temperature rise at equilibrium in an electro-magnetic flexometer patterned after that described by Gehman et al.* Temperature is measured at the interface of two cylindrical test pieces, ⅜ inch in diameter and ½ inch high, subjected to a 60 cycle stroke 1 mm. in amplitude. Average of two tests reported.

Cut-Growth Resistance (Hot): Number of flexes required to cause a 1-cm. increase in length of a nick in a grooved de Mattia flex piece. The samples are maintained at 100°C (212°F) and are flexed at a rate of 120 cycles per min. through an angle of 83° to open the cut and through a 20° angle in the opposite direction to compress the cut. Average of two tests reported.

Abrasion: Abrasion loss, in cc. per kilometer, on the Akron Angle Abrasion machine, using an angle of 15° and a Norton stone No. 19846-KD. The original machine was modified by the installation of a new gear drive and the provision of an air jet to keep the stone clean.

Summary

By addition of HAF black and an unsaturated petroleum type softener to a conventional cold rubber tread stock in the ratio of 0.94:1, it is possible to increase the total loading of the compound by at least 70% with no marked effects on the properties of the vulcanized stock and with substantial improvement in processing characteristics. In view of this improvement and the accompanying savings in cost, it is suggested that this type of compound should be given serious consideration by tire and camelback manufacturers.

ACKNOWLEDGEMENT

Thanks are extended to C. H. Klute, who directed the testing of the experimental compounds. The assistance of J. D. Brown and others who participated in the compounding and testing program is gratefully acknowledged.

* *Ind. Eng. Chem.*, Vol. 35, p. 964 (1943).

Reports of Avoidable Accidents

BELOW are recorded a few additional instances of avoidable accidents as recently reported in the *Rubber Safety Newsletter* issued by the Rubber Section of the National Safety Council:

Feeding Tubing Machine: A man was feeding stock into a tubing machine, pushing it down the feed chute with his fingers, when a lop of stock wrapped about his arm, caught his finger and pulled it into the feed screw. Since he tripped the safety just about the time that his finger came into contact with the screw, no injury resulted. This incident could have produced an extremely serious injury; the cause would have been disregard of instructions. A push stick was provided for feeding the stock into the screw, and instructions had been given to keep the hand out of the feed chute at all times. A basket guard around the feed chute might be devised for this operation to make it impossible to use the hands for feeding stock.

Grinding Wheel Accident: While a man was grinding his pocket knife on the wheel, it was caught and thrown into his face. There were a guard and a small shield over the wheel, but the guard was only part-way down and the shield was in such a position that the knife passed to one side of it and struck the man over the spectacles, showering his eye with broken glass. In addition to more thorough enforcement of the rule on the wearing of protective goggles while grinding, this case emphasizes the vital necessity of keeping guards and shields in proper position to do their protective jobs.

Injury by Electric Power Truck: A workman had just finished backing an electric power lift truck under an empty skid when a tractor horn was blown behind him. He threw up the handle of the truck in a hurry, causing the truck to stop suddenly with his foot close to the wheel. The machine rebounded an inch or two so that it came to a stop on his foot. Instructions to operators of these tractors were modified to emphasize the need for keeping clear of the machine while the power is on.

Hand Truck Injury: While three men were attempting to load a roll of liner onto a hand truck, one of them braced his foot against the truck wheel to hold the truck while the liner was tipped over onto it. When the roll of liner landed on the truck, the latter backed up and caught his toe under the wheel. The injury in this case would undoubtedly have been prevented if safety shoes had been worn, or if the wheels of the truck had been blocked with something less fragile than a foot while a heavy load was being put on the truck. Here again the fundamental correction is emphasis on education in proper methods of work. Special trucks are available for handling liners without tipping the rolls over.

CORRECTION

Credit for the development of the Orthogonal Strip Adhesion Test in Part I of the series of articles on "Additional Developments in the Field of Testing Procedures for the Evaluation of Natural and Synthetic Rubbers and Plastic Elastomers," which appeared in our October, 1949, issue, was given to Mr. Chatten and Mr. Taylor of the Material Laboratory, New York Naval Shipyard. The development was actually accomplished by Mr. Chatten and Mr. Saul Eller.

Division of Rubber Chemistry, A. C. S., Meets in Detroit on April 19, 20 and 21

AS PREVIOUSLY announced, the 1950 Spring Meeting of the Division of Rubber Chemistry, A.C.S., will be held at the Book-Cadillac Hotel in Detroit, Mich., on Wednesday, Thursday and Friday, April 19, 20 and 21. The meeting will feature the presentation of twenty-five technical papers, the divisional banquet, and a business session. A luncheon-meeting of the 25-Year Club will be held in the English Room of the Book-Cadillac at noon on April 19. Ed Kvet (Baldwin Rubber) is chairman of the luncheon. One of the features of the business session will be the adoption of revised by-laws, copies of which have already been supplied to the membership. One of the major differences between the proposed and existing by-laws is in the method of election of directors from the sponsored local groups. Two-year rather than one-year terms are proposed. Titles, authors and abstracts of the technical papers scheduled follow herewith:

Program of the

DIVISION OF RUBBER CHEMISTRY
AMERICAN CHEMICAL SOCIETY

Book-Cadillac Hotel, Detroit, Mich.
April 19-21, 1950

Wednesday Afternoon—April 19

2:00 P.M.—Introductory Remarks by Dr. F. W. Stavely (Firestone), Division Chairman.
2:10 P.M.—Technical Papers.

Thursday Morning—April 20

9:00 A.M.—Technical Papers.
10:30 A.M.—Business Meeting.
11:00 A.M.—Technical Papers.

Thursday Afternoon—April 20

2:00 P.M.—Technical Papers.

Thursday Evening—April 20

7:00 P.M.—Division Banquet, Book-Cadillac Hotel.

Friday Morning—April 21

9:00 A.M.—Technical Papers.

ABSTRACTS OF PAPERS

Wednesday Afternoon—April 19

2:10 P. M.—Reclaiming Agents for Natural and Synthetic Rubber. I. Solvent Naphtha. *D. S. le Beau (Midwest Rubber Reclaiming Co., East St. Louis, Ill.).*

Coal tar solvent naphtha has been used for a number of decades as a reclaiming agent. However, very little is known as to which of the compounds contained therein are effective in the reclaiming process and which are not. Furthermore, the composition of solvent naphtha varies with the conditions of coking by which it is obtained and naphthas obtained from different sources of supply are not necessarily identical in their composition.

The present study was carried out for two reasons: (1) To provide a means of control of a raw material used in reclaiming processes and thereby provide a uniformly processed end product; (2) To ascertain, if possible, the chemical character of those compounds in solvent naphtha which are active in the reclaiming of natural and synthetic rubber and to gain thereby a better insight into the reactions occurring during the reclaiming process.

For this purpose coal tar naphthas of three different sources of supply as well as a petroleum naphtha of an equivalent distillation range were subjected to repeated fractional distillation in a Todd column. Refractionations of the original fractions clearly showed the predominance of mixed boiling point effects, making any distillation analysis of these products of questionable value for the present study. For the same reason also factory control of the naphtha by distillation is of little value beyond the determination of the initial and final boiling point.

Refractionation of the naphtha into three boiling point ranges (130-160° C., 165-175° C. and 180-190° C.) and the use of each of these fractions as reclaiming agents for natural rubber showed significant differences in the reclaims produced therefrom.

A search of the literature available on the composition of coal tar and petroleum naphthas revealed a number of groups of hydrocarbon compounds whose presence had been ascertained therein. Those compounds which fell within the upper and lower limits of the boiling points of the naphthas studied were individually investigated for their reclaiming capacity of vulcanized GR-S and vulcanized natural rubber at a given temperature and over a range of reaction times. On the basis of this study certain chemical configurations present in some of these hydrocarbon compounds were found to be highly effective as reclaiming agents, while others were inert.

The effective compounds were found to be absent in petroleum naphtha. (Experience has shown that petroleum solvent naphtha is not an effective reclaiming agent). If the number of these effective groups was decreased for a given compound, the reclaiming effectiveness of that compound decreased. At the same time, however, it was ascertained that such a decrease in effective groups did not affect the plasticizing effect this compound exerted on the unvulcanized polymer. Furthermore, the hydrocarbon compound particularly effective as a reclaiming agent of vulcanized natural rubber was not an effective plasticizer of unvulcanized natural rubber. Thus, a compound found effective as reclaiming agent for the vulcanized polymer cannot *eo ipso* be assumed to be an effective plasticizer for the crude polymer, and vice versa.

Fractionation curves of the various naphthas and data on the evaluation of the reclaims are presented and the structure of hydrocarbons and their effect on reclaiming will be discussed.

2:35 P. M.—Some Problems Involved in the Grading and Testing of Natural Rubber. II. Mastication and Compounding. *R. F. Blackwell, C. M. Blow, W. P. Fletcher, L. Mullins, and R. I. Wood (British Rubber Producers' Research Association, Welwyn Garden City, England).*

A progress report on the work being carried out by the British Rubber Producers' Research Association on the variability of the vulcanization characteristics of natural rubber was presented at the Atlantic City meeting of the Division of Rubber Chemistry, A. C. S., in September, 1949. The uniformity of properties in vulcanizates prepared from different consignments of natural rubber is important, but, from a rubber goods manufacturer's

point of view, it is just as essential that rubber stocks should be uniform in their behavior during processing operations carried out prior to vulcanization. This paper directs attention to this second "quality."

In the laboratory investigation of factors responsible for mixing, curing and testing errors, it was found that the correlation between the viscosity of the mixed stock and the modulus of the vulcanizate was highly significant over a wide range of rubber samples from different estates. Thus, there are two reasons for the importance of uniformity of processing behavior, first, to insure constant extruder and calender performances, and second, to maintain constant modulus of vulcanizates. An investigation, involving an extensive series of mixings prepared under controlled conditions, showed an absence of correlation between the viscosity of the raw rubber and that of the stock prepared from it. This suggests that factors during mastication and compounding are responsible for some of the observed variations; these are discussed in the first part of this paper.

The majority of the data was obtained on pure gum compounds, but work is in hand on the technically very important black loaded stocks, and the second part of this paper includes a discussion on the anomalous behavior of these stocks in the unvulcanized condition. They show thixotropic behavior, and their viscosity and processability may change considerably with apparently slight changes in the method of treatment; this gives an extra source of variability. In addition this thixotropic behavior makes it difficult to obtain precise and reproducible measurements of the properties of these stocks.

3:00 P. M.—Effect of Air on Banbury Breakdown of Low Temperature GR-S Polymers. ***C. J. Tiger, M. H. Reich, and W. K. Taft (Government Laboratories, University of Akron, Akron, Ohio).***

Low temperature GR-S polymers have been reputed to break down more slowly during mastication in the Banbury or Gordon Plasticator, to require more power to mix with black, and to develop higher temperatures during mixing and extrusion than were previously encountered with GR-S or GR-S-10 made at 122° F.

Various approaches to the problem have included the use of lower loadings and processing temperatures, large amounts of softeners, and chemical plasticizers. Presumably, none of these has been entirely satisfactory because of reduction in either factory capacity or product quality.

Preliminary work at the Government Laboratories showed that mastication of low temperature polymers in a Laboratory Size B Banbury at a normal loading of 1400 to 1475 grams (90 to 95% of capacity) resulted in either little or no breakdown or in actual resinification. The processing temperatures ranged from about 375° to about 535° F. Reduction in the loading of the Banbury to about 80 to 85% of capacity (1200 to 1300 grams) resulted in lower processing temperatures (260° to 330° F.) and polymer breakdown, although the rate of breakdown was lower than experienced with GR-S or GR-S-10 at either the normal or reduced loading. Mastication of low temperature polymers in a Mooney viscometer and heat softening in a forced-draft oven at 265° and 300° F. both showed the low temperature polymers to break down faster than did the GR-S-10 control. This observation, coupled with earlier work which showed the elimination of air from natural rubber in the Banbury or in an autoclave to result in poor breakdown, led to the introduction of air into the Banbury mixing chamber during mastication of low temperature polymers.

When air at 47° to 89° F. was introduced into the Banbury at a rate of 2.9 to 9.6 cubic feet per minute, GR-S polymers X-478, X-510 and X-530, made at 41° F., were broken down at rates comparable with those of GR-S or GR-S-10 when masticated without air. Normal loadings of 95% of capacity could be utilized. Polymer dump temperatures ranged from 265° to 350° F., dropping with increased mastication time. Although variation in either the temperature or the rate of flow of air within the range noted showed no effect upon the rate of breakdown of a given polymer, some indication was obtained that either increased flows of air or better dispersion of the polymer with the air would be necessary to give optimum breakdown rates for some of the more sensitive low temperature polymers encountered.

The mill shrinkage, roughness, compounded Mooney viscosities, extrusion, aged and unaged stress-strain, abrasion and flex-hysteresis properties of the stocks broken down in the presence of air compared favorably with the properties of the same polymers which had been compounded on the mill without Banbury pretreatment. The total effects of the Banbury treatment were similar to those obtained by the usual Banbury mastication of GR-S and GR-S-10.

3:20 P. M.—Factors Influencing the Dispersion Styrene-Butadiene Resins. ***H. S. Sell and R. J. McCutcheon (Goodyear Tire & Rubber Co., Akron, Ohio).***

The trend within the industries using large volumes of high styrene reinforcing resins has been away from pre-masterbatching of the resin and rubber and toward direct incorporation of the resin into the batch. Direct incorporation into the Banbury requires a resin which will provide rapid incorporation on fast, low temperature Banbury mixing cycles. In this study, factors which contribute to the ease of incorporation of the resin, such as the physical form of the resin, the particle size of the resin, the flow characteristics of the resin, and the softening point of the resin, were studied on controlled Banbury mixing cycles. The influence of the state of dispersion upon the physical properties of the resulting stock was also determined by curing and testing the stocks produced in the dispersion studies.

While changing the particle size of a given resin does not affect the physical properties imparted by the resin, except as influenced by the state of dispersion, changes in softening point of the resin involve changes in the polymer with resultant changes in physical properties of stocks into which it is incorporated. For this reason, in those series involving changes in softening point of the resin, the physical properties of end use stocks were also considered in addition to the dispersion characteristics.

Based upon considerations of dispersibility and resultant physical properties, a resin was selected which represented the best balance of these properties and comparisons were made with commercial resins representing a wide range of softening point, particle size, and flow characteristics.

3:45 P. M.—An Auto-Pneumatic Apparatus for Measuring Stress Relaxation. ***C. S. Wilkinson, Jr., and S. D. Gehman (Goodyear Tire & Rubber Co., Akron, Ohio).***

An apparatus for measuring stress relaxation in rubber under compression is described. Expansion of a "Sylphon" bellows by air pressure compresses small cylindrical test pieces. As stress in the samples decreases due to relaxation, air is automatically released through an ordinary tire valve, thus maintaining the force at a magnitude just sufficient to keep the sample at a constant compressive strain. The force, which is a function of the air pressure within the bellows, is calculated from readings of this pressure as indicated by an accurate Bourdon type gage directly connected to the bellows. The amount of compression is indicated by a dial micrometer connected to one end of the bellows. The entire apparatus is very compact, simple, and completely self-contained. Accuracy of the instrument was checked by comparing results with those obtained using a resistance wire strain gage.

Experiments were made upon GR-S compounds over a temperature range extending from —20° F. to 212° F. Somewhat greater rates of stress decay were observed for the extreme low and high temperatures in this range than for intermediate temperatures. The effect of cure was investigated for Hevea and GR-S compounds. In all instances longer cures gave lesser rates of stress decay. The effect of temperature on initial stress, the influence of degree of compression on the rate of stress decay, and results obtained from varying the type and amount of carbon black were also investigated. A study of the stress relaxation during the test in relation to the permanent set observed after the termination of the test is included.

4:05 P. M.—The Effect of Ammonia on the Electroplating of Neoprene Latices. ***Dave T. Williams and Stephen Palinchak (Battelle Memorial Institute, Columbus, Ohio).***

A thick, porous film is plated on a zinc plate at 30 volts from neoprene latices, containing no ammonia. A thick film is also obtained when sodium or potassium hydroxide is added to the latex. Neoprene Latex Type 571 gave a heavier coat than Type 601 or Type 842. If a series of films is plated from a liter of Neoprene Latex Type 571, containing 10% neoprene,

the weight of the film remains constant for the first few films followed by a decrease in the film weight. This decrease in weight cannot be explained entirely by the decrease in the rubber content of the latex. It seems to be more a function of the type of particles that are plated on the first few films. A similar result was noted for Type 842, although the loss in weight was not as great. No decrease in weight was noted for Type 601.

When 10 mls. of 28% NH_4OH was added to a liter of each of the three latices at 10% neoprene content, the weight of plated film dropped sharply. The heaviest coat was obtained with Neoprene Latex Type 571 and the lightest with Type 842. The weight of the films for each latex increased with higher concentrations of NH_4OH. With 30 mls. of NH_4OH, Type 842 gave the heaviest film.

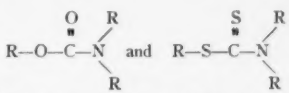
Change in current with time was studied for the various latices during plating. It was found that the current dropped very rapidly in the first few seconds of plating time and then decreased more gradually. This drop was very rapid when NH_4OH was added.

Plots of the variation of the weight of films with plating time for the latices with and without NH_4OH will be presented.

Thursday Morning—April 20

9:00 A. M.—Esters of Dialkyldithiocarbamic Acid as Plasticizers for Acrylonitrile Rubbers. ***Arthur William Campbell (Commercial Solvents Corp., Terre Haute, Ind.).***

The esters herein described were originally prepared in an accelerator of vulcanization study. However, the esters so severely plasticized natural rubber when used at 10% concentration that the emphasis was shifted to this phenomenon. The oxygen analogues were studied and reported in a previous paper. Comparisons are given in this paper between the following typical compounds:



The dithiocarbamate esters were tested in natural and acrylonitrile rubber as accelerators and were found to be essentially non-accelerating. When compared in acrylonitrile rubber the oxygen compounds and the sulfur compounds were very similar in activity:

Plasticizers Tested in Hycar OR-15	*Firestone Plasticity*
Control—no plasticizer	366 seconds
Butyl-N,N-diisopropylcarbamate	6 seconds
Butyl-N,N-diisopropyldithiocarbamate ..	4 seconds

The odor of the sulfur compound is more pronounced than that of the oxygen compound and is objectionable to some. However, impurities seem to be the source of the odor.

9:15 A. M.—The Tetramethyl Thiuram Disulfide (TMTD) Vulcanization of Extracted Rubber. I. The Essential Features of Tetramethyl Thiuram Disulfide Vulcanization. ***A. E. Juve, David Craig, and W. L. Davidson (B. F. Goodrich Research Center, Brecksville, Ohio).***

A study has been made of certain aspects of the problem of vulcanization of natural rubber with tetramethyl thiuram disulfide (TMTD) in the absence of elemental sulfur. This system was chosen for study because it was felt to be somewhat less complex than vulcanization with S_8 when carried out with the usual auxiliary materials and also because it lent itself very satisfactorily to two new techniques: the short path still technique and the use of radioactive tracer elements.

By the short path still technique all the fragments and reaction products of the TMTD, except the sulfur which is combined with the rubber and the ZnS which is formed in the reaction, can be removed from the vulcanizates, permitting analyses of the products from which an estimate can be made of the reactions occurring during vulcanization.

As a necessary preliminary to the main part of this study and also concurrent with the latter, certain compounding studies were carried out to determine the role of several auxiliary materials in the system being investigated and also to study the effects of certain of the decomposition products and reaction products on the course of the vulcanization. The principal conclusions of this part of the study are the following:

(1) Using rubber from which the naturally occurring fatty acids have been removed, it is shown that fatty acids are not required for satisfactory vulcanization and have but a slight effect on the vulcanizate properties.

(2) The minimum quantity of ZnO required for optimum properties is about 1.5 PHR.

(3) Tetramethyl thiuram monosulfide (TMTM), a product present during vulcanization with TMTD, when added in large proportions to a TMTD-ZnO-rubber system or to a S_8-ZnO-rubber system inhibits their vulcanization.

(4) ZnS when used as a replacement for the ZnO in a TMTD-rubber system is a fairly effective activator.

(5) Zinc dimethyl dithiocarbamate (Zn DMDC) when added to a TMTD-ZnO-rubber system is devoid of activating properties but in the absence of ZnO does have some activating effect.

(6) Vulcanization of a TMTD-ZnO-rubber system is inhibited by H_2S and dodecylmercaptan.

(7) Zinc or compounds of zinc apparently do not become a part of the vulcanizate structure during cure since their removal by conversion to zinc dimethyldithiocarbamate (Zn DMDC) and subsequent distillation had no appreciable effect on the physical properties of the vulcanizate.

9:40 A. M.—The Tetramethyl Thiuram Disulfide (TMTD) Vulcanization of Extracted Rubber. II. Radioactivity Studies Bearing on the TMTD Vulcanization Mechanism. ***W. L. Davidson, D. Craig, A. E. Juve, and I. G. Geib (B. F. Goodrich Research Center, Brecksville, Ohio).***

Radioactive tetramethyl thiuram disulfide (TMTD*) has been prepared in good yield through the reaction of tetramethyl thiuram monosulfide (TMTM) with sulfur containing S^*. The activity of the resulting TMTD* implies a random distribution of all the sulfurs present. Pyrolysis of the TMTD* produced sulfur (S_8*), tetramethyl thiourea (TMTU*) and CS_2* in nearly theoretical yield. Again, the activity of each product was in keeping with its sulfur content. These results, together with the short path distillation and cryoscopic behavior (in benzene) of TMTD plus the retarding effect of TMTM on TMTD vulcanizates, lead us to postulate that the TMTD molecule is a hybrid of two contributing forms, possessing a planar six-membered ring in which all four sulfur atoms are chemically equivalent.

Data will also be presented to show how the tagged sulfur becomes distributed among the following systems, contacted at curing temperatures:

(a) TMTD* + zinc dimethyl dithiocarbamate (Zn DMDC)
(b) S_8* + TMTD
(c) S_8* + ZnDMDC
(d) S_8* + ZnDMDC + TMTD
(e) S_8* + CS_2
(f) S_8* + dimethyl ammonium dimethyl dithiocarbamate (DMADC)
(g) S_8* + CS_2 + DMADC
(h) TMTD* + ZnO
(i) TMTD* + KCN

The manner in which the sulfur activity is distributed among the products isolated from vulcanizates employing (1) TMTD* and (2) TMTM + S_8* will likewise be considered.

10:05 A. M.—The Tetramethyl Thiuram Disulfide (TMTD) Vulcanization of Extracted Rubber. III. The Nature of Zinc Activation. ***David Craig, A. E. Juve, and W. L. Davidson (B. F. Goodrich Research Center, Brecksville, Ohio).***

Zinc activation of TMTD vulcanization is related in this paper to the buffering action that zinc compounds have or may be presumed to possess toward the concentration of hydrogen sulfide. The action of zinc palmitate, zinc oxide, zinc sulfide and zinc dimethyldithiocarbamate as activators and as buffers will be discussed. The technique described in Part I was used in determining the palmitic acid that rubber will release in the short path still from a mixture of rubber and zinc palmitate. For one sample used this amounted to one equivalent weight of palmitic acid for 26,000 gms. of rubber. Thus very little buffering action can be ascribed to the acidic nature of rubber. The importance of regulating the concentration of hydrogen sulfide stems from

the previous observations of others that high concentrations inhibit vulcanization but that low concentrations are activating in nature.

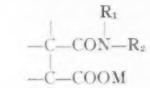
The reaction of TMTD with hydrogen sulfide in the absence of rubber, as has been known for some thirty years, forms free sulfur and dimethyldithiocarbamic acid. This acid decomposes to CS_2 and dimethylammonium dimethyldithiocarbamate (DMADC). In the presence of rubber part of the sulfur may be combined in the vulcanizate but, due to the methylenic nature of rubber, some of the TMTD is wastefully used up in producing hydrogen sulfide. This is especially important in the absence of zinc compounds because hydrogen sulfide was found to effect the decomposition of tetramethylthiuram monosulfide (TMTM). This decomposition was then found to be catalyzed by DMADC produced by the reaction of TMTM with H_2S.

TMTM appears to be an important if not essential intermediate in TMTD vulcanization since it represses the formation of higher polysulfides (even free sulfur, S_8) and permits the formation of a lower polysulfide. This sulfide, perhaps the thiuram trisulfide, may be the most efficient for vulcanization. It is important, therefore, that TMTM be not used up by reaction with H_2S. A little H_2S is necessary to react with TMTD in order to form the trisulfide. Understandably, Levi had no success in isolating the trisulfide. We now can surmise that it tends to disproportionate and if rubber is present, vulcanization will occur.

Considerable evidence has been collected to support the view that TMTD vulcanization as well as sulfur vulcanization is the formation of a copolymer of sulfur with rubber double bonds in such a way that copolymer chains are formed more or less perpendicular to rubber chains. If not suitably controlled the methylenic nature of rubber retards the copolymerization process by supplying hydrogen sulfide as a "modifier" in too great a concentration. The zinc compounds appear to "activate" because they "regulate" the modifier.

11:05 A. M.—A New Class of Organic Accelerator-Activators Derived from Amic Acids. *M. C. Throdahl, R. O. Zerbe, and D. J. Beaver (Monsanto Chemical Co., Nitro, W. Va.)*

A class of compounds derived from amic acids has been found to possess valuable accelerator-activator properties for natural rubber and GR-S. Amic acids, or the half amides of dicarboxylic acids, and their salts have the general structure



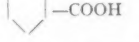
where R_1 and R_2 are hydrogen, alkyl, aralkyl, or cycloalkyl groups, and M is hydrogen or a salt forming group such as a metal (i.e., zinc), ammonia, or an amine. The amic acid derivatives described in this paper are from:

oxamic acid, $COONH_2$; $COOH$

maleamic acid, $HC{-}CONH_2$; $HC{-}COOH$

succinamic acid, $H_2C{-}CONH_2$; $H_2C{-}COOH$

and phthalamic acid,



Unsubstituted phthalamic acid had a slight retarding effect on vulcanization. However, replacement of one or both hydrogens on the amido nitrogen atom with a non-aromatic substituent gave products with definite activating properties. Strongest activators of this class are non-aromatic amine salts of the amic acids in which at least one hydrogen of the amido group is replaced. Unsubstituted oxamic acid, its several esters and salts were found to retard cure. Maleamic acid likewise retarded cure; however, the alkylamine salts of N-alkyl maleamic acids were found to be comparable to the corresponding phthalamic acid derivatives. In contrast to oxamic and maleamic acids succinamic acid as well as derivatives prepared from it were found to be definite activators.

Many of the compounds tested in rubber stocks, particularly the alkylamine salts of alkyl substituted phthalamic acids, were stable low melting solids and dispersed very readily. Compounding data, scorch and cure characteristics, and other physical properties are shown for many of the compounds.

11:30 A. M.—Oxidation of Olefins Representing Some Structural Units of GR-S. *W. C. Warner (General Tire & Rubber Co., Akron, Ohio) and J. Reid Shelton (Case Institute of Technology, Cleveland, Ohio).*

1-Phenyl-4-hexene, 1-phenyl-3-pentene, and 2-octene were oxidized in the liquid phase with molecular oxygen at several temperatures near 100° C. Samples were removed periodically during oxidation for an iodometric peroxide analysis and for determination of unsaturation by bromato-bromide titration. The graphically determined instantaneous rate of oxidation was found to be related to the olefin and peroxide concentrations by the following equation:

$$\text{Rate} = k\,[\text{unreacted Olefin}]\,[\text{Peroxide}]$$

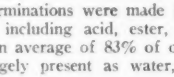
where Rate = Moles O_2/Mole Original Olefin/Hour and the brackets represent molarities.

1-Phenyl-4-hexene was the most active of the three olefins studied. The phenyl group was found to activate when separated by three methylene groups from the double bond, but when separated by only two, the rate was slower than for the unsubstituted aliphatic compound. The rates were sufficiently close, however, to indicate that the same fundamental mechanism and rate-determining reaction apply to all three olefins.

Increase in temperature raised the overall autocatalytic rates in a reproducible and regular manner enabling them to be used as a direct measure of relative reactivity. Conversely, increase in temperature lowered the overall rates in the subsequent linear portion which is consistent with the fact that formation of secondary oxidation products and a modified mechanism became important in this later stage. The reaction rate constants from the above equation gave energies of activation for the overall oxidation reaction on the order of 22,000 cal./mole for phenyl hexene and phenyl pentene, which is of an order of magnitude consistent with true chemical reaction and indicates that the rate was determined by the chemical process and not by physical processes such as diffusion.

Quantitative determinations were made for functional groups containing oxygen, including acid, ester, carbonyl, carbon dioxide and water. An average of 83% of oxygen was accounted for which was largely present as water, carbon dioxide and ester.

A free radical chemical mechanism is postulated consistent with the general kinetic mechanism of Bolland insofar as reaction at the α-methylene group is concerned. It is further postulated that initial oxygen attack at the double bond (which apparently takes place to some extent) may result in the formation of a peroxide biradical,



This radical may react with other molecules of olefin either to form polymeric peroxides by reaction at the double bond or to initiate the usual chain reaction mechanism by removal of hydrogen from the α-carbon of the olefin.

Thursday Afternoon—April 20

2:00 P. M.—Alfin-Catalyzed GR-S Type Polymers. *H. Goldsmith and W. K. Taft (Government Laboratories, University of Akron, Akron, Ohio).*

Alfin catalysts are reagents developed by A. Morton of the Massachusetts Institute of Technology for use in the polymerization of synthetic rubber. They contain two sodium salts of a

special type which act as aggregates of ions and induce an extremely rapid polymerization of butadiene, isoprene, and butadiene-styrene resulting in polymers of unusually high molecular weight (1.5 to 2.0 x 10^6). The physical characteristics of the polymers can be regulated by the type of reagent employed in ways not known for any other polymerization system. Because each catalyst consists of a salt derived from a secondary *AL*cohol paired with that from an ole*FIN*, the name Alfin was chosen.

The preparation of these catalysts, by varying the type of alcohol and hydrocarbon, was described by Morton at the September, 1949, American Chemical Society meeting in Atlantic City. Originally, only polybutadiene was prepared in bottles. This stock was extremely tough and had very poor milling and processing properties. Attempts to heat-soften the polymer, to add various plasticizers, to break down the polymer on the mill or in a Brabender Plasticator, and to prepare the stock in the presence of carbon black for improved carbon black dispersion were unsuccessful. To improve processing properties, a 75/25 BD/S Alfin polymer was made; this stock had tensile strengths approximately 25% higher than those of GR-S, improved processing properties compared to the polybutadiene, a quality index of 20.0 because of extremely long flex life, good abrasion resistance, and excellent retention of tensile strength and flex life upon aging. The very high flex life and tensile strengths and the excellent retention of these properties upon aging were found to be the most outstanding characteristics of the Alfin polymer.

Considerable quantities of 75/25, 80/20, and 90/10 BD/S polymers were prepared in a one-gallon reactor using various catalysts prepared by Morton. Stress-strain data were obtained at 77° and 212° F. on aged and unaged stock, along with flex-life, hysteresis-heat rise, gel, dilute solution viscosity (DSV), abrasion, and freeze tests. Since the processibility was still quite inferior to that of GR-S, attempts were made to soften the polymer by the addition of plasticizers, by milling, and by swelling the stock in the solvents. All attempts proved impractical. Banbury mastication was then tried to break down the polymer. The viscosity was reduced to a Mooney viscosity of 169 ML-4 in 31 minutes in a Size B Banbury mixer. The stress-strain properties of this stock were improved over that of the untreated stock.

Since other work at the Government Laboratories showed that low temperature GR-S could be broken down at a higher rate when air was introduced during mastication, this method was tried. When air at 60° F. was fed into the Banbury at a rate of 5 to 10 cubic feet per minute, the Mooney viscosity of the Alfin 75/25 BD/S copolymer was decreased to 100 ML-4. The tensile strengths and elongations were reduced by approximately 8%. The DSV of the 100 ML-4 polymer was 1.55 and the quality index was reduced from 20 to 4.5, the abrasion efficiency remaining at 154% (GR-S is 100%). The use of heated air (90° to 125° F.) broke down the Alfin polymer to a 40 ML-4 Mooney viscosity stock in 29 minutes. The DSV of this stock was 1.31 and the quality index 3.6. The abrasion efficiency was not affected by mastication. Compared to those of standard GR-S, tensile strengths of unaged and heat-aged stocks and the processing and extrusion properties were excellent.

2:20 P. M.—Recent Developments in GR-S Latex Polymerized at Low Temperatures. *H. S. Smith, H. G. Werner, C. B. Westerhoff, and L. H. Howland (U. S. Rubber Co., Naugatuck, Conn.).*

Since presentation of the last paper on this subject [*Ind. Eng. Chem.*, Vol. 41, p. 1584 (1949)], plant production of 50% solids "cold" latex has been started, at first on a limited scale but presently in steadily increasing quantities. The first formula, X-544, in which cumene hydroperoxide was used as the catalyst, was produced for only a short period. It was succeeded by X-547, in which the use of diisopropylbenzene hydroperoxide as catalyst gives notably faster reaction rates while slight changes in the soap system have eliminated high viscosity and gelling during polymerization. Since X-547 was first introduced reaction rates have been almost doubled. This has been brought about by stringent exclusion of oxygen in the system and by certain changes in loading procedure.

Since the start of commercial production, YNA (dimethyl-ammonium dimethyldithiocarbamate) has been used as the polymerization shortstop. This material is ideal for the purpose since it is effective in small concentrations, non-destabilizing to latex, non-discoloring, completely water-soluble, and moderate in price.

Although X-547 is normally produced at 48-50% solids, for some applications it is necessary to have 60% solids content. As a means to this end, the Maron (cold filtration) method, heat concentration, and creaming have been investigated. The last two methods appear particularly promising.

Heat concentration has been carried out with a plate-type heat exchanger. This type of exchanger, widely used in the food and beverage industries, does not foul readily and is easily cleaned. Considering the nature of the material, surprisingly high overall heat transfer coefficients are obtained, ranging from 150 to 300 B.t.u./hr./ft.^{2}/°F. The use of a simultaneous stripping and concentration cycle using this exchanger is being actively investigated. Present indications are that such a process would require no more time than is needed for stripping alone. In addition, the heat which would be used for concentration alone in a standard cycle would serve a double purpose here, since it would also aid in stripping off monomers.

Development work on the creaming of X-547 has shown that previous concepts of creaming costs may be drastically revised when dealing with large-particle latices. Because of this large particle size, the amounts of creaming agents required in the concentration of X-547 from 48 to 60% solids are only about 20% of that required in creaming a small particle size latex such as Type IV.

2:45 P. M.—The Structure of Neoprene Type W. *W. E. Mochel and J. B. Nichols (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).*

Neoprene Type W is a general-purpose polychloroprene elastomer prepared by an improved emulsion polymerization of chloroprene. It is superior to the other commercial neoprenes in many properties, such as stability, processing characteristics, and response to a variety of vulcanization systems. Properly compounded vulcanizates of Neoprene Type W resemble those of other neoprenes in most physical properties, such as resistance to oils, sunlight, ozone, and flame, but they resemble natural rubber in stress-strain characteristics and are outstanding in improved compression set. To exhibit these differences, Neoprene Type W would be expected to have a molecular structure different from that of other neoprenes. Some aspects of the molecular structure of Neoprene Type W are discussed in this paper.

Neoprene Type W has been shown by fractional precipitation from benzene solution to have a molecular weight distribution more uniform than that of other neoprenes or GR-S and, in fact, it approaches natural rubber in this respect. Furthermore, Neoprene Type W has a higher average molecular weight than Neoprene Type GN or CG or GR-S. On the basis of reported correlations between plasticity and molecular weight distribution for other polymers, it is believed that this more uniform distribution and higher molecular weight in Neoprene Type W is largely responsible for the improved processing characteristics over those exhibited by the other neoprenes. The viscosity-molecular weight relationship of Neoprene Type W is essentially the same as that for Type GN but is significantly different from that observed for Neoprene Type CG.

Neoprene Type W also has a greater uniformity of molecular structure than is found in other neoprenes or GR-S. Ozonolysis of Type W and examination of the fragments has failed to yield any evidence for lateral double bonds such as are reported for GR-S. While ozonolysis has indicated that the structures of all the neoprenes are essentially the same, Type W has yielded a somewhat higher proportion of the polymer as succinic acid arising from linear poly-2-chloro-2-butenylene units. X-ray diffraction studies have shown that Neoprene Type W crystallizes more readily than Neoprene Type GN, indicating greater uniformity of structure in the former polymer. Since the identity period for crystallites of Type W is the same as that observed for other neoprenes, there appears to be no difference in the crystalline structures of the various neoprenes; i.e., only the trans-1,4-addition polymer is involved.

Some of the other improved properties shown by Neoprene Type W, such as its outstanding storage stability in raw stocks or cements and its response to conventional rubber vulcanization systems, probably are attributable to other factors than uniformity of molecular weight distribution. For example, Neoprene Type W contains no free sulfur or vulcanization accelerator to interfere with conventional vulcanization acceleration systems.

3:20 P. M.—Aging Studies on Redox Polymers. ***C. R. Parks, J. O. Cole, and J. D. D'Ianni (Goodyear Tire & Rubber Co., Akron, Ohio).***

Polymerization recipes currently employed for commercial production of "cold rubber" contain iron in the form of the ferrous pyrophosphate complex. In view of the possible adverse effect of iron on the aging of GR-S type polymers a comparison was made of the aging of GR-S prepared by the Mutual and Iron-Redox polymerization systems.

Aging of GR-S polymers and vulcanizates was evaluated by oxygen absorption measurements and by change in physical properties during accelerated aging. The stability of GR-S raw polymers was found to vary widely. In general, raw polymers prepared by the Iron-Redox system were less stable toward oxidation than raw polymers prepared by the Mutual polymerization system. It was observed that some of the Iron-Redox raw polymers were very unstable toward oxygen. Vulcanizates derived from Iron-Redox polymers were found to be only slightly inferior in stability as compared with the corresponding vulcanizates derived from polymers prepared by the Mutual recipe.

In view of the uncertainty as to the chemical form in which iron is present in Iron-Redox polymers after coagulation of the latex, the activity of iron in various chemical forms as an oxidation catalyst was measured. Of the forms of iron which may be expected to exist in an Iron-Redox polymer only the more soluble forms such as iron soap and ferric chloride exhibited appreciable activity. The effect of soluble iron on the oxygen absorption rate of the GR-S raw polymer was detectable at a concentration as low as 3 parts per million. Evidence is presented that soluble iron is the main factor in the poor stability of some Iron-Redox polymers toward oxygen. Synthetic samples prepared either by addition of soluble iron to a GR-S polymer or ferrous pyrophosphate complex to GR-S latex, absorbed oxygen at a rate comparable with that observed for Iron-Redox polymers. The satisfactory aging of "cold rubber" vulcanizates is probably the result of the fortuitous circumstance that soluble iron is converted to an inactive form during cure.

3:45 P. M.—Polymerization Recipes for 41° F. "Sugar-Free" Redox Systems. ***V. C. Neklutin, C. B. Westerhoff, and L. H. Howland (U. S. Rubber Co., Naugatuck, Conn.).***

At the present time, three basic recipes are being used in the commercial production of "cold" rubber. The earliest recipe, employing the "high sugar" type activator, was developed during 1946 and 1947 and was used in plant scale production in 1947. The "low sugar" activator recipe followed into plant production in 1948. After these two, the "sugar-free" recipe was developed and finally went into plant production in late 1948. In all cases an oil soluble hydroperoxide was used as the catalyst.

This paper presents the chronological development of 41° F. recipes starting with the earliest "sugar-free" type in which an insoluble ferrous sulfate-potassium pyrophosphate complex was used as an activator.

Following this, the ferrous sulfide activator, in which the sulfide not only combines with the iron to form a slightly soluble compound, but also regenerates the ferrous iron from the ferric as it is formed, was studied and is now being used in high solids latex at 50° F.

During further study, it was found that ferrous soap prepared *in situ* was a good activator for polymerization when fatty acid soaps were used for emulsification. This technique did not work well in recipes containing mainly rosin type soaps.

During the attempts to activate the ferrous sulfate-rosin acid soap recipe, it was discovered that sodium silicate (SiO_2/Na_2O weight ratio of 2.90 to 3.75) could be used to form a colloidal precipitate which acted as an activator. Further improvements led to the development of the ferrous silicate recipe, which up to date is the most economical and simplest of 41° F. ferrous iron activated recipes.

The most recent development utilized certain polyethylene polyamines as the activators in place of the ferrous iron salts. These appear to have an advantage in ease of operation since there is only one ingredient in the activator and there is no problem over the oxidation of ferrous iron prior to the polymerization.

All of the above recipes, with cumene hydroperoxide as the catalyst, can be balanced so as to obtain sixty per cent conversion in six to fifteen hours. With the advent of more active oxidizing agents, such as diisopropylbenzene monohydroperoxide, the above recipes can be used to obtain rates resulting in 60% conversion in two to three hours.

The physical tests on the tread vulcanizates of the "sugar-free" type polymers indicate them to be as good as the "sugar" type polymers in all properties.

In general, the advantages for the synthetic rubber manufacturer developed in the better recipes discussed above are: (1) Simpler operation; (2) Better uniformity; (3) Freedom from pH drop on latex storage, and (4) Cheapness.

The advantage to the consumer lies in a better uniformity of product at equal quality as compared to the "sugar" type polymers, particularly in the case of carbon black masterbatches.

4:10 P. M.—Evaluation of Butadiene-Styrene Elastomers for Low Temperature Service. ***Philip Mitton, J. J. Boyle, C. B. Griffis, and C. M. Brown (Engineer Research and Development Laboratories, Fort Belvoir, Va.).***

Most rubber products become rigid and nonresilient, if not brittle, at very low temperatures (under arctic conditions). Previous work by other agencies has indicated that polybutadienes and butadiene copolymers containing only small amounts of styrene were superior to standard GR-S and other rubbers in regard to cold resistance.

Ten elastomers of the butadiene-styrene system, prepared by the Office of Rubber Reserve, have been evaluated in regard to suitability for service at temperatures down to —65° F. These elastomers included polybutadienes, copolymers of 10 parts of styrene to 90 parts of butadiene, and copolymers of 30 parts of styrene to 70 parts of butadiene formed at temperatures from 145° to 14° F. Vulcanizates of standard formulations of these polymers were tested for tensile strength, ultimate elongation, tension and compression modulus and resilience at room temperature; for compression set at 158° F.; and for compression recovery, tension recovery, stiffness, hardness and brittleness at —65° F.

Tests at —65° F. were performed on specimens which had been aged for 15 minutes, 1 day, 7 days and 28 days at —65° F. in order to determine the effect of time of exposure.

Friday Morning—April 21

9:00 A. M.—A Study of the Aqueous Dispersion Characteristics of Carbon Blacks. ***E. M. Dannenberg and K. P. Seltzer (Godfrey L. Cabot, Inc., Boston, Mass.).***

One of the major contributions of the Government Synthetic Rubber Program to the advancement of the rubber industry has been the development and production of carbon black masterbatches. Black masterbatches are prepared by mixing an aqueous dispersion of carbon black with latex and coagulating this mixture by the introduction of salts and acids. Black masterbatch thus produced consists of an intimate mixture of carbon black and rubber and can be considered as a new raw material form offering many advantages to the rubber manufacturer. The use of black masterbatch eliminates the handling of dry carbon black in the factory and also can reduce the time and power ordinarily required to mix carbon black and rubber.

The process for the large scale and economical production of satisfactory quality black masterbatch necessitates careful control of the colloidal properties of the aqueous carbon black dispersion and the mixture of this dispersion and latex. In the interest of furthering the development of the process this paper presents information on the factors influencing the preparation and properties of aqueous dispersions of carbon black.

The first step in preparing a dispersion of carbon black is to wet the black with water containing the necessary dispersing agents. It has been found that the controlling variables in this step are the bulk density of the black and the amount of extractable hydrocarbon material present on the surface of the black. Fluffy blacks of low bulk density are difficult to wet. High extract also retards wetting.

Depending upon the particular grade and sample of carbon black, the concentration of black, and the amount of dispersing agent, the mixture of carbon black and water may be a low viscosity fluid, thixotropic, or a heavy bodied paste. The ease of dispersion of a sample of carbon black can be judged by measuring the maximum solids content of a black dispersion having a

fluid consistency using a given amount of dispersing agent. An equivalent technique is to determine the quantity of dispersing agent required to produce a system having a fluid consistency with a given percent solids content of black. It has been found that the dispersing agent requirements for various carbon blacks using this latter method are influenced by the following properties: (1) the degree of mechanical aggregation of the dry carbon black, (2) the surface area of the black as determined by nitrogen and solution adsorption methods, (3) the amount of inorganic contaminants usually determined as the ash content, and (4) surface oxidation or the amount of chemisorbed oxygen.

It is shown that surface oxidation and a high degree of mechanical aggregation promote good dispersibility. High area and high ash reduce the effectiveness of dispersing agents resulting in higher dispersing agent requirements.

The amount of mechanical aggregation of the dry carbon black influences the ultimate degree of dispersion that can be obtained in water, particularly if relatively slow speed mixing conditions are employed. The agglomerates which are produced in the dry state in order to make pelletized carbon black for the rubber industry are not completely dispersed in water and are carried over into the final black masterbatch product. Since these same agglomerates are dispersed in rubber by the usual dry mixing and milling operations, there is no obvious reason why the same performance cannot be expected in the compounding of black masterbatch.

9:30 A. M.—New Developments in Masterbatching Carbon Black with GR-S Latices. ***J. W. Adams, W. E. Messer, and L. W. Howland (U. S. Rubber Co., Naugatuck, Conn.).***

Coprecipitates of carbon blacks and GR-S, or "black" types of GR-S as they are often called, are made commercially by flocculating mixtures of latices and carbon black slurries to produce masterbatched compounds. Since the details of the process have been previously described the purpose of this paper is to present certain advances in latex masterbatching with particular reference to tire tread compounds of channel and high abrasion furnace (HAF) types of rubber compounding blacks in GR-S polymerized at low temperatures. Latex types, carbon black slurry preparations and the treatment of carbon black-latex mixtures are discussed separately for the purpose of simplifying the presentation.

Most types of elastomer latices can be mixed with aqueous carbon black dispersions and the resulting mixtures coprecipitated to produce masterbatches. Prior to 1948, however, this particular process in the synthetic rubber industry was centered, primarily, around producing latex masterbatched compounds from copolymers of butadiene and styrene (GR-S) that were polymerized at temperatures around 122° F. Early in 1948 new types of "cold" GR-S and furnace blacks were available for the first time in substantial quantities for elastomer compounding. At that time plant production of low temperature GR-S latex incorporated black masterbatches began and the quantity of these materials produced has steadily increased. Various latices polymerized at temperatures below 50° F. were coprecipitated with carbon blacks and it was indicated that improved vulcanizates could be prepared from these products.

High abrasion furnace (HAF) types of carbon black and certain types of unpelletized channel blacks imparted additional improvements to the quality of vulcanizates from latex incorporated masterbatches. For this reason much of the development work on the preparation of black slurries was concerned with these particular types of carbon black. Test methods were developed to evaluate dispersing agents, determine the dispersing agent requirements of carbon blacks and determine the quality of carbon black slurries. The methods developed were instrumental in establishing the following facts regarding carbon black slurry preparation:

1. In the range of 15-25% carbon black a linear relationship exists between dispersing agent requirements of slurries and their carbon black content.
2. Sodium hydroxide has a greater complementary effect on the dispersing efficiencies of some surface active materials than on others.
3. A partially desulfonated sodium lignin sulfonate was found to be the most efficient dispersing agent for preparing aqueous dispersions of rubber compounding blacks.
4. Douglas fir bark dust contains a good dispersing agent for carbon blacks.
5. The order in which ingredients were added in preparing slurries was found to be important.
6. The quality of carbon black slurries was ascertained by determining the particle size index of the dispersed black. Dispersing agent and sodium hydroxide concentrations both affect the quality of carbon black slurries.

Latex incorporated carbon black masterbatches prepared according to plant processes often contain carbon black-GR-S agglomerates that are difficult to break up and disperse by normal compounding practices. Attempts were made to determine the causes of agglomeration and develop methods for improving this condition that imparts such undesirable properties as low tensile strengths, moduli and abrasion resistance to vulcanizates.

When sodium chloride creaming, sulfuric acid flocculating processes were used to coprecipitate some carbon black-latex mixtures inferior products were obtained. It was discovered that the highly loaded particles formed during creaming, which contained from 40-50% carbon black, were responsible for poor vulcanizate quality.

Conditions under which sodium salts of condensed alkylnaphthalene sulfonates could be used in stabilizing black-latex systems were investigated. Certain cationic surface active agents and polyethylene polyamines were found to be compatible with flocculating solutions containing sulfuric acid and could be used in small quantities to effectively neutralize materials that belong in this class of dispersing agents.

The temperature at which carbon black-latex mixtures were flocculated influenced the completeness of coprecipitation and the properties of vulcanizates from masterbatches. The best temperature for flocculation was found to be 50° C. (122° F.).

Vulcanizates from masterbatches prepared from homogenized carbon black-latex mixtures were found to have higher moduli and tensile strengths. These changes in physical properties were produced by improved carbon black dispersions.

9:55 A. M.—Carbon Gel as Revealed by the Electron Microscope. ***W. A. Ladd and M. W. Ladd (Columbian Carbon Co., New York, N. Y.).***

The electron microscope is one of the principal test instruments for proving the physical existence of the carbon gel complex announced during the past year by the Columbian Research Laboratories. With this instrument it has been possible to trace the formation of polymer gel with and without carbon present, either through the agency of heat alone, or dynamically as in the Banbury in the presence of carbon black. The various techniques of specimen preparation used in this study are described. A large number of photomicrographs of the polymer sol and gel portions as well as carbon gel are shown. Included are photomicrographs of sections cut with the high speed microtome.

10:20 A. M.—The Mechanism of Reinforcement: The Nature of the Interaction Between Carbon Black and Polymer in Cured Elastomers. ***R. S. Stearns and B. L. Johnson (Firestone Tire & Rubber Co., Akron, Ohio.).***

The improvement of one or more physical properties of vulcanized rubber stocks by the incorporation of a finely divided solid is known as reinforcement. There exists a number of theories as to the mechanism by which a solid of high surface area, such as carbon black, will improve abrasion resistance, increase tensile strength and increase the modulus of the cross-linked polymer matrix. However, no completely satisfactory conclusions have been reached as to the nature of the interaction at the interface between the polymer molecules and the surface of the solid inclusion. In general, it has been considered that Van der Waal type of adsorption forces are responsible for this interaction. However, there can be found in the literature a number of references to "chemical binding" between polymer and pigment, usually in reference to carbon blacks.

The work to be described in this paper was undertaken in order to determine the nature of the interaction between various carbon blacks and inorganic pigments and the polymer chains in the cross-linked polymer matrix. The conclusion is reached that carbon black particles are really large organic molecules containing various functional groups which are capable of reacting with sulfur during vulcanization to combine the carbon black and the polymer into a continuous three dimensional network. It is shown that the thermodynamic properties of a loaded stock, such

as modulus, are highly dependent on the ability of the pigment to be "cross linked" to the polymer molecules.

The first section of the paper deals with the thermodynamics of retraction of gum and loaded stocks. Emphasis is placed on the attainment of equilibrium conditions. The work of retraction, W_R, calculated from the area under the equilibrium stress-strain curves is shown to be proportional to the entropy change accompanying the deformation. It was found possible to express the effect of the solid pigment on the elastic properties of the cross linked matrix by two constants ϕ $W°_{R_2}$ and k. The constant ϕ $W°_{R_2}$ represents the apparent amount of work contributed by one cm^3 of pigment to the work of retraction as the volume fraction of pigment approaches zero and the constant k is associated with particle-particle interaction. Three EPC blacks, two RF blacks, an SRF black and two inorganic pigments were examined. All pigments except the SRF black were of approximately equal particle size and area. High values of ϕ $W°_{R_2}$ were obtained for the six carbon blacks ($0.5\text{-}0.8 \frac{\text{cal.}}{\text{cm}^3}$) while low values of ϕ $W°_{R_2}$ were obtained for the inorganic pigments ($0.1 - \frac{\text{cal.}}{\text{cm}^3}$). This pronounced difference in behavior between carbon black and inorganic pigments of equal area can be explained by assuming a chemical bond between polymer and pigment in the case of the carbon blacks while in the case of the inorganic pigments the polymer is only physically adsorbed on the surface of the solid.

The second section is concerned with the chemical nature of the carbon black surface. By a calorimetric method which involves measuring the integral heat of reaction of bromine with carbon blacks in a CCl_4 slurry, it is shown that carbon blacks contain a large number of reactive ethylenic type double bonds on their surfaces. It is pointed out that a carbon black particle should be considered as a large organic molecule containing a number of functional groups capable of undergoing ordinary chemical reactions. During vulcanization, the polymer is linked to the carbon black through carbon-sulfur-carbon bonds so that the entire carbon black-polymer system is combined into a three dimensional matrix.

In the third section it is shown that ϕ $W°_{R_2}$ is a function of the number of double bonds per unit of available surface area, for pigment particles of approximately equal size. RF blacks were found to have between 500-600 available double bonds per particle while EPC blacks contain from 250-350 available double bonds per particle. This means that RF blacks will be more tightly bound to the polymer than EPC blacks and as a consequence the stresses in the vicinity of an RF black particle will be greater than in the vicinity of an EPC black particle. The stresses in the vicinity of an inorganic pigment will be low since the polymer is only physically adsorbed on the surface of the pigment by Van der Waal forces and consequently the polymer segments can migrate on the surface to relieve the stresses.

The recognition of the chemical nature of the bonding between carbon black particles and polymer in the cured polymer matrix is of great value in explaining and correlating many of the reinforcing properties of carbon blacks and in particular accounts for the differences in the reinforcing ability of pigments of equal size and area.

10:55 A. M.—Electrical Resistivity of Various Carbon Blacks in Natural, GR-S, Cold and Butyl Rubbers. *L. R. Sperberg, G. E. Popp, and C. C. Biard (Phillips Chemical Co., Bartlesville, Okla.).*

During the past two decades the problem of electrical conductivity of rubber products has become increasingly important. Several papers have been published on the subject but they have dealt primarily with test methods. The effects of compounding variables on electrical conductivity have been investigated but little work has been published on the more practical aspects of the problem.

The work reported in this paper was performed to investigate the effects of black dispersion, type of black, type of rubber, and flexing action upon electrical resistivity. In addition, the relationship between surface and volume resistivity was studied. Various types of black covering in brief the broad carbon spectrum were studied. Natural, GR-S, Butyl and cold rubber were evaluated.

The degree of milling has a major effect upon electrical resistivity of certain blacks (e.g., Philblack A) but has a relatively negligible effect upon others (e.g., Philblack O, acetylene black). Resistivity decreases with an increase in black loading for all blacks studied. The type of rubber employed exerts a pronounced effect, with the resistivity decreasing in the following order—cold rubber, GR-S, natural rubber and butyl rubber. Surprisingly, the conductivity is only slightly affected by flexing which is contrary to the generally accepted idea. It is postulated that differences in electrical properties of various polymers may be attributable to the degree of dispersion of the carbon black inherent in the particular polymer. Surface and volume resistivity results are similar.

11:20 A. M.—Effect of Carbon Blacks on Heat Transfer Characteristics of Vulcanizates. *L. R. Sperberg, L. H. Harbison, and J. F. Svetlik (Phillips Chemical Co., Akron, Ohio).*

A knowledge of the thermal characteristics (combined effects of thermal conductivity and heat capacity) of rubber compounds is of interest because of its marked effect on the two properties of cure rate and heat build-up with flexing. The relationship to these two properties may readily be seen. If the conductivity of a raw rubber mix is high and the heat capacity is low, the vulcanization rate will be increased since such a mix will heat up very rapidly. Conversely, in the case of dynamic heat build-up, if the thermal characteristics of a vulcanizate are high, the heat generated with flexing will be dissipated more rapidly and a lower equilibrium temperature will be realized.

Since little information on this subject is available in the literature the work described in this paper was undertaken to provide some information on the effect of carbon blacks on heat transfer characteristics of rubber mixes.

The following blacks were studied in a GR-S tread type formula containing 50 parts of black per 100 parts of rubber: SRF (Gastex), conductive channel (Spheron N), EPC (Wyex), acetylene black, HMF (Philblack A) and HAF (Philblack O). In addition, Philblack A at 10, 30, and 75 parts loading was studied to determine the effect of carbon black loading upon thermal characteristics. A gum compound was also included for comparative purposes. Conductive channel and acetylene black were studied to determine if thermal and electrical conductive characteristics were by chance related.

The heat transfer characteristics were determined by placing thermocouples in a block of rubber (made by plying up several slabs of rubber) and observing the temperature rise with time of the test block when it was inserted between the platens of a 24" x 24" steam press maintained at 307° F.

The results show that blacks differ markedly in their effects upon overall heat transfer characteristics. The effects are as follows in descending order of rate of heat transfer: Acetylene black, Philblack O and Philblack A, SRF (Gastex), EPC (Wyex), and CC (Spheron N). A decrease in the black loading from 75 to 0 parts decreases the heat transfer rate. The degree of dispersion of the black appears to have no effect upon this property. If a poorly conducting stock is backed with a highly conducting stock the poorly conducting compound heats up more rapidly than if it were used alone.

11:50 A. M.—Effect of Colloidal Non-Carbon Pigments on Elastomer Properties. *Ernst Schmidt (Firestone Tire & Rubber Co., Akron, Ohio).*

A number of pigments other than carbon black are known which reinforce certain physical properties of rubber to various degrees, but do not, in general, equal or surpass the reinforcing ability of carbon black. Extensive investigations of carbon blacks have revealed that particle size is an important factor in reinforcement and that the most efficient carbon blacks have particle sizes of not more than 250 to 350 A. U. Most of the commercial non-rubber reinforcing pigments, however, are of considerably larger particle size and differ from carbon black also with regard to particle shape and some of them with regard to their readiness to disperse in rubber.

The question arises, therefore, whether the outstanding reinforcing properties of certain carbon blacks are primarily due to their particle size, shape and distribution or to the unique struc-

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Editorials . . . . . .

Rubber Legislation

ACTION on rubber legislation for the next few years is in the offing. The end result of the public hearings held in Washington by the special House Armed Services Rubber Subcommittee was a decision to recommend a three-year extension of the present law (Public Law No. 469) combined with recommendations to the Commerce Department for a "more lenient" exercise of the controls governing the amount of synthetic rubber to be produced and consumed. Both government officials and industry executives appeared during the hearings.

It was obvious from the very beginning of the hearings that Representative Carl Vinson (Dem., Ga), head of the special rubber subcommittee, was convinced that few changes should be made in existing legislation because of the continued need for national security where synthetic rubber is concerned. While industry executives are not in agreement on this score, they should be deeply grateful to Mr. Vinson on another. He immediately recognized the danger of extending existing legislation for a ten-year period, as recommended by President Truman and seconded by government witnesses during the hearings. Further, he recognized the need for setting limitations on the administrators of the law.

Government ownership of the synthetic rubber plants and government operation of the synthetic rubber program has never been objectionable to the rubber manufacturing industry. Despite the testimony of a Commerce executive to the effect that the industry was more concerned with profits than with national security, every plan advanced by industry has taken cognizance of the need for maintaining synthetic rubber production facilities in actual or stand-by condition. The industry recognizes, however, that so long as mandatory usage continues, plant disposal presents difficult problems. If, however, a program of eliminating usage controls on some satisfactory basis can be established, then the problems of disposal will be greatly simplified.

The question may be raised: Why the emphasis on private operation of the synthetic rubber plants? The answer to that question is tied in with our national economy and our American way of life. Not until the breath of competitive life is blown into the program will there be the progress needed to establish synthetic rubber firmly in world markets. Only under competitive conditions will greater and faster technological advancement be achieved. Under present regulations it is not possible to use available facilities for test runs of new developments without prior approval and disclosure to the government—and competitors. This situation is hardly conducive to effective research or evaluation of promising developments.

Since private operation of the synthetic rubber facilities is deterred by mandatory consumption controls, industry has submitted three basic plans of operation designed to overcome the specific problem involved. All three of these plans, details of which appear elsewhere in this issue, provide production and consumption levels sufficient to meet the minimum requirements of national security, currently set at 200,000 long tons a year. The first plan calls for leasing the synthetic plants to industry by next October, with minimum production per plant specified in the leases; the second would transfer plants on a lease-and-purchase basis extended over the next year, with industry and government sharing production for the next two years, while the third would continue government control of the plants for the next two years but would gradually reduce mandatory consumption requirements on a specified basis.

There is some merit in each of these plans and each warrants the attention of Congress. It is easily conceivable that the legislators could combine the plans or prepare a new one achieving both the aims of government for national security and of industry for freedom of operation. Extending current legislation without some definite program of transferring the plants to private industry simply means postponing the day of decision between natural and synthetic rubber. The specific problems of plant disposal will still be with us in 1953. As long as national security needs can be met, amendments should be incorporated in any new rubber legislation designed to let industry assume the full problems of synthetic rubber in a free, open and competitive market.

CURRENT NEWS OF THE MONTH

CONGRESSIONAL SUBCOMMITTEE RECOMMENDS EXTENDING RUBBER CONTROLS FOR 3 YEARS

THE Special House Armed Services Rubber Subcommittee, which recently concluded hearings on President Truman's recommendations for a new ten-year rubber program, has endorsed the continuance of the present synthetic rubber law for another three years. The subcommittee, headed by Representative Carl Vinson (Dem., Ga.), heard the testimony of various Government and industry representatives. Other members of the committee, which is part of the House Armed Services Committee, included Representatives Philip J. Philbin (Dem., Mass.), F. Edward Hebert (Dem., La.), Dewey Short (Rep., Mo.), W. Sterling Cole (Rep., N. Y.), and Paul W. Shafer (Rep., Mich.). At the insistence of the Republican members of the subcommittee, Chairman Vinson and the other Democratic members agreed to couple to the bill a "strong" and strict enjoinder to the Commerce Department directing it to substantially curb the use of its power to require industry to consume specified quantities of synthetic rubber for tires. The enjoinder, in the form of an official committee report, will direct the Commerce Department to give industrial users as much latitude as possible in meeting the 200,000-ton security figure without compulsion.

Representative Shafer, author of the Rubber Act of 1948, led the fight in the subcommittee for the "strongly-worded" enjoinder. He said the flat, three-year extension of the Rubber Act was not to his liking, and that it will not satisfy industry. Mr. Shafer said that he will continue to press for a more reasonable approach to control authority when the bill comes before the House.

Meanwhile, it was reported that several "influential" Senators will also move for the Shafer approach, authorizing standby controls to be used only if the industry fails to consume voluntarily the required 200,000 tons GR-S tonnage. Chairman Lyndon Johnson (Dem., Tex.) has not yet scheduled hearings before his Senate Armed Services Subcommittee.

Government Testimony

Secretary of Commerce Charles Sawyer, in his appearance before the House Subcommittee, which began its hearings on February 20, said it was the Government's stated policy to get out of the synthetic rubber business as soon as possible. He added that without some gradual program such as the ten-year plan recommended by the President in January, the synthetic rubber industry would get no nearer to becoming a self-sustaining part of the economy than it is today.

Secretary Sawyer was sustained in his views by Earl Glen, head of the Rubber Division of the Commerce Department. Mr. Glen, in two appearances before the subcommittee, said that without full-scale mandatory controls, he fears industry would virtually abandon synthetic for natural rubber and come back in a few years with a request for only a "token" synthetic rubber industry.

He also stated that the Phillips Petroleum Co. and the Standard Oil Co. had expressed interest in the purchase of synthetic rubber facilities. Only their interest has been discussed, he said. Further talks, he testified, await Congressional action on what is to be done about disposal.

After the conclusion of the Government testimony on February 22, Chairman Vinson decided to adjourn the hearings. The Rubber Manufacturers Association, in a telegram to the subcommittee, "urgently requested" to be heard, claiming that the Government's testimony did not reflect industry's views. Alleged "misrepresentations," it was stated, were those by Earl Glen, when he told the subcommittee that industry "objected" to changing the present method of controls and that "no one" was interested in buying a Government rubber plant. The subcommittee accordingly decided to extend the hearings.

W. J. Sears, executive vice-president of the Rubber Manufacturers Association, appeared before the subcommittee on February 23. Firms in the industry cannot agree among themselves, Mr. Sears said, on how to guarantee minimum output and consumption of synthetic rubber for purposes of national security, or when the producing facilities should be transferred to private operation.

Mr. Sears also said that the 19 rubber manufacturing concerns comprising the National Security Policy Committee are in agreement that 10 years is much too long for the proposed legislation. Private industry agrees on the importance of maintaining a synthetic rubber potential, he said, and goes along with the present security minimum figures proposed by the Administration under the present law.

That ultimate private ownership and operation of the industry is in the best interests of the nation is also supported by all the rubber firms, Mr. Sears stated. They do not, however, believe that Government plants can be sold to private companies while mandatory use regulations are continued in effect.

Three Alternative Methods

Mr. Sears said the industry is not in complete agreement on how to accomplish a "transitory" shift of synthetic rubber plants to private ownership, but its thinking has narrowed down to three alternative methods. These are:

Method A—This plan provides for negotiating leases with appropriate national security provisions and incorporating therein an agreement to produce, sell and use security minimums of GR-S keeping in production all present operating units so as to protect the operating teams and know-how. Leases to be negotiated as soon as possible and not later than October 1, 1950. The security minimum tonnage to be 200,000 long tons incorporated in the lease agreements with whatever additional voluntary use may be available.

All leases become effective on the same date. Each plant so leased is assigned an individual security minimum tonnage which they guarantee to produce and consume or sell. No maximum limit is placed upon their output. Government guarantees adequate supply of butadiene if such facilities are not concurrently leased or sold to private industry.

Munitions Board to establish a GR-S stockpile of 200,000 long tons of GR-S. Government to be authorized to sell GR-S to any bona-fide consumer of GR-S from stockpile on a rotation basis. The law to provide that at least 5% GR-S must be consumed in certain tires and camelback to prevent adverse advertising.

Method B—Two-year legislation specifying a time schedule for the transition of ownership and operation of synthetic rubber-producing facilities from Government to private industry. The first year of legislation to be a disposal period during which lease or purchase of synthetic rubber facilities is to be negotiated, with actual transfers to become effective on July 1, 1951. During this period, Government to continue as sole producer and supplier of general purpose synthetic rubber.

The second year to be a period for evaluation of the ability of general purpose synthetic rubber to hold its ground

in competition with natural rubber. During this period, Government will continue as sole supplier of mandatory use general purpose synthetic rubber, and private industry will be the sole supplier of voluntary use general purpose synthetic rubber. Mandatory rubber to be purchased by Government at cost on a pro-rata basis from private operators, and sold to all mandatory users by Government at a Government-established price.

Mandatory controls to provide, for the two-year period, a combined mandatory and voluntary consumption level of 200,000 long tons annually, with provision for progressive reduction of mandatory tonnage to test the ability of general purpose synthetic rubber to compete with natural rubber in a free market.

Method C—Retention of authority for an R-1 Order with a specific provision of law requiring the specified use of GR-S in tires and repair materials to be reduced by ⅓ of the present R-1 order every six months beginning July 1, 1950, provided that total consumption of GR-S during the preceding six-months was greater than 100,000 long tons.

If total use of GR-S falls below 100,000 long tons in any six-month period it be required to increase specified use for the ensuing six months to reasonably assure total consumption of 100,000 long tons.

During the two-year period specified use must not be lower than a token amount not exceeding 5% GR-S in certain tires and camelback. A GR-S stockpile of not less than 175,000, nor more than 250,000 long tons should be accumulated.

Operators of Government copolymer plants, under certain limitations, should be permitted, without prior approval, to manufacture general purpose type polymers which they develop through private research. On or before January 15, 1952, the rubber industry to report to Government on recommendations for sale or lease of the plants.

Industry Testimony

While the committee had been hesitant in receiving testimony from individual concerns, Chairman Vinson finally asked the representatives of private industry to present their views on the proposed legislation. Those who finally appeared before the subcommittee included: R. S. Wilson, vice-president of Goodyear; J. Ward Keener, vice-president of Goodrich; Charles F. Burke, assistant to the president of General Tire; Harvey S. Firestone, Jr., chairman of Firestone; George Tisdale, vice-president of U. S. Rubber; and A. L. Freedlander, president of Dayton Rubber, who appeared as a representative of the Copolymer Corp.

As it developed, Firestone, General Tire and U. S. Rubber supported Method A of the plans submitted by W. J. Sears of the Rubber Manufacturers Association. Method B was backed solely by Goodrich. Goodyear and the Copolymer Corp. gave their approval to Method C.

J. H. Nesbit, chairman of the executive committee of the Rubber Reclaimers Association, stated to the subcommittee that he favored keeping synthetic at security levels. He further stated that he did not wish to see his product crowded out of the overall rubber market by the synthetic product. A. L. Grant of the Charles T. Wilson Co., and Harold E. Poel of H. A. Astlett & Co., also favored keeping synthetic at security levels.

Still another private industry view was given to the committee by R. C. Jopling, vice-president of the Phillips Petroleum Co. Mr. Jopling stated that all private industry needs is to be told how much rubber it is expected to produce and then be left alone. He recommended that minimum consumption of GR-S be set at 300,000 long tons a year.

Aftermath of Testimony

As an aftermath of the testimony presented before the subcommittee, the Rubber Manufacturers Association filed a detailed rebuttal to the testimony of Mr. Glen, who, it was charged, had "impugned with vigor the motives of industry witnesses in matters of national security."

Mr. Glen had told the committee his private opinion was that each of the three schemes presented by industry leading toward more private participation in production and use of synthetic rubber would work against the security interests of the nation. His arguments hinged on the contention that only mandatory Government specifications have kept the use of synthetic rubber as high as it is today.

The RMA statement noted that Mr. Glen, when testifying as an individual, had supported the extension of the present law rather than the Administration's ten-year program. Earlier, Mr. Sears said that the RMA resents the implications that proper consideration had not been given to national security. He insisted that even the least drastic of industry's plans would make a significant contribution to the value of synthetic rubber by putting it to the test, while maintaining minimum controls, of competing with natural rubber on its own merits.

U. S. Rubber has published a comprehensive guide to the selection, care and use of power belting for tractors, combines and other types of farm machinery. Forty-eight pages in size, it is described as the most complete listing of its kind yet issued in the belting industry.

Relax Camelback Rules

Regulations covering the mandatory consumption of GR-S in all types and sizes of camelback were dropped by the Commerce Department on March 9. The order issued on that date actually applied only to small size camelback since mandatory regulations covering the larger sizes had previously been eliminated. It was estimated that aproximately 12,000 to 15,000 long tons of GR-S would have been used in small size camelback in 1950 under mandatory requirements. It is assumed that the greater portion of camelback of this size will now be produced with natural rubber.

RUBBER SECRETARIAT REPORTS ON PRODUCTION-CONSUMPTION IN 1949

World production of natural and synthetic rubber in 1949 totaled 1,922,500 long tons, and world consumption 1,875,000 tons, according to estimates of the Secretariat of the Rubber Study Group. These figures represent declines from 1948, when production and consumption set records of 2,052,000 tons and 1,900,000 tons, respectively.

Natural rubber production dropped from 1,520,000 tons in 1948 to 1,482,500 tons in 1949, the Secretariat estimated. The main decline was in Malaya, where production fell 28,000 tons to about 670,000 tons, chiefly because of reduced output by small holders. Total exports from Indonesia declined only 10,000 tons, to 422,000 tons, but exports of Indonesian native rubber were reduced by 67,000 tons, to 264,000 tons.

Consumption of natural rubber in 1949 set a new record of 1,427,500 tons, up 7,500 tons from 1948. Estimated imports into Russia increased from 100,000 tons to 105,000 tons, and other foreign consumption rose sharply from 692,500 tons to 746,000 tons, according to the Secretariat. U. S. consumption, however, fell from 627,500 tons in 1948 to 576,500 tons in 1949.

Production of synthetic rubber, excluding Russia, declined from 532,000 tons in 1948 to 440,000 tons in 1949, and was closely in line with consumption which, again excluding Russia, declined from 480,000 tons to 447,500 tons.

Stocks of natural rubber, excluding Russian stocks, and strategic stocks in the United States, the United Kingdom, and France, were estimated at 757,500 tons at the end of 1949, compared with 755,000 tons a year earlier. End-of-1949 synthetic stocks were estimated at 110,000 tons, down 15,000 tons from the previous year.

Changes at Cameron Machine

Joseph S. Scheuermann, associated with the Cameron Machine Co. since 1926, when he joined the company as sales representative in the mid-western area, has resigned as vice-president and sales manager. His successor as sales manager will be announced in the near future, but in the interim sales will be under the direct supervision of P. J. Lathrop, president of the company. In the reorganization of sales activities, Eugene Ward, service manager, was appointed assistant sales manager. Mr. Ward's former duties will be assumed by John Dain, supervisor of demonstrators.

Movie Covers Rubber Smuggling

The frantic efforts of the Allied Nations to smuggle crude rubber from Southeast Asia shortly after the Jap occupation in 1942 is now portrayed in a movie recently produced by the Metro-Goldwyn-Mayer organization. Called "Malaya," the film combines manufactured melodrama with authenticity, the combination resulting in a highly entertaining adventure film. "Malaya" stars Spencer Tracy, James Stewart, Sydney Greenstreet and Lionel Barrymore.

INSTITUTION OF RUBBER INDUSTRY SEEKS NORTH AMERICAN MEMBERS

The Institution of the Rubber Industry, which has its headquarters in London, England, but which is international in character, has launched a drive, with the aid and cooperation of the Division of Rubber Chemistry of the American Chemical Society, for additional members in North America. Both organizations have come to a mutual understanding that membership in both, exchange of papers, and cooperative effort in general are much to be desired.

The I.R.I., which was founded in 1921 and which is firmly established as a scientific and technical center of the rubber industry, seeks as its aim the advancement of scientific and technical methods in the development of the manufacture and use of rubber and the advancement of the attainments, character and status of those engaged in the industry. It is thus worldwide in its objectives and appeal and membership is to be desired.

Members of the I.R.I. are spread throughout the globe, with rubber technologists from almost every country contributing to its lectures and publications. Flourishing sections exist in Australia and India with additional sections planned for South Africa and possibly Japan. The weakest link in this world fraternity of rubber men at present lies in representation in the United States and Canada, and the current drive is aimed at amending that situation.

Aims of the Institution

The Institution has several new aims in mind in extending invitations to membership to its friends in North America. It hopes to see young Americans and Canadians attending courses with Europeans, South Africans, Australians, Indians and others at the newly-founded National College of Rubber Technology in London. It would like to receive papers in increasing numbers from American and Canadian technologists for publication in the *I.R.I. Transactions*. It would like to arrange lecture tours in all countries, to send delegates to all rubber conferences, and to see all countries represented at the summer vacation residential courses it proposes to arrange at one of the Colleges at Oxford.

According to Mr. G. E. Holmes-Siedle, registrar, achievement by the Institution of its full aims will be to the benefit of the rubber industry as a whole and the support of rubber manufacturers, scientists, technologists and executives in North America will be needed to carry out the program in the Western Hemisphere.

Full details concerning membership in the organization can be secured by writing to the Institution of the Rubber Industry, 12, Whitehall, London, S.W. 1, England.

Cosom Industries, Minneapolis, Minn., recently introduced a practice golf ball made of Bakelite polyethylene. The ball follows the same line of flight as a regulation golf ball when hooked, sliced, or hit squarely, but travels only about one-tenth as far.

Coming Events

Mar. 17. Boston Rubber Group, Somerset Hotel, Boston.

Mar. 23. Quebec Rubber & Plastics Group, Canadian Legion Hall, Montreal.

Mar. 24. Chicago Rubber Group, Morrison Hotel, Chicago.

Mar. 28-31. Fourth National Plastics Exposition (SPI), Navy Pier, Chicago.

Mar. 31. Akron Rubber Group, Mayflower Hotel, Akron.

Apr. 4. Buffalo Rubber Group, Elks Temple, Buffalo.

Apr. 12-14. A.S.M.E., Spring Meeting, Washington, D. C.

Apr. 19-21. Rubber Division, A.C.S., Spring Meeting, Book-Cadillac Hotel, Detroit.

Apr. 20. Quebec Rubber & Plastics Group, Canadian Legion Hall, Montreal.

Apr. 28. N. Y. Rubber Group, Henry Hudson Hotel, New York.

May 12. Chicago Rubber Group, Morrison Hotel, Chicago.

May 19. Buffalo and Ontario Rubber Groups, Joint International Meeting, General Brock Hotel, Niagara Falls, Ontario.

June 3. Southern Ohio Rubber Group, Annual Outing.

June 16. Akron Rubber Group, Annual Outing.

June 16. Boston Rubber Group, Annual Outing.

June 16. Quebec Rubber & Plastics Group, Annual Golf Tournament.

June 19-22. A.S.M.E., Semi-Annual Meeting, St. Louis, Mo.

June 23. Detroit Rubber & Plastics Group, Annual Outing, Forest Lake, Mich.

June 26-30. A.S.T.M., Annual Meeting, Chalfonte-Haddon Hall, Atlantic City.

July 14. Buffalo Rubber Group, Annual Outing.

Sept. 14. Southern Ohio Rubber Group, Engineers Club, Dayton.

Sept. 19-21. A.S.M.E., Fall Meeting, Worcester, Mas.

Oct. 6. Detroit Rubber & Plastics Group, Detroit-Leland Hotel, Detroit.

Oct. 11-13. Rubber Division, A.C.S., International Rubber Meeting, Hotel Cleveland, Cleveland.

Oct. 20. N. Y. Rubber Group, Henry Hudson Hotel, New York.

Oct. 20. Boston Rubber Group, Somerset Hotel, Boston.

Nov. 26-Dec. 1. A.S.M.E., Annual Meeting, New York, N. Y.

Dec. 8. Detroit Rubber & Plastics Group, Xmas Party, Detroit-Leland Hotel, Detroit.

Dec. 15. N. Y. Rubber Group, Xmas Party, Henry Hudson Hotel, New York.

Dec. 15. Boston Rubber Group, Xmas Party, Somerset Hotel, Boston.

Dec. 16. Southern Ohio Rubber Group, Xmas Party.

TARIFF COMMISSION ISSUES DATA ON RUBBER PROCESSING CHEMICALS

Production of rubber processing chemicals of both the cyclic and acyclic types in the United States in 1948 amounted to 96,014,600 pounds, or 5% less than the 101,000,000 pounds reported for 1947, according to the latest data compiled by the U. S. Tariff Commission. Sales in 1948 totaled 71,690,300 pounds, valued at $36,389,700. The unit value per pound was 51 cents.

The output of cyclic materials, chiefly accelerators and antioxidants, amounted to 81,851,100 pounds compared with approximately 85,800,000 pounds in 1947, a decrease of 5%. Sales of these compounds in 1948 totaled 60,330,600 pounds, valued at $26,997,600, or a unit value of 45c per pound.

Production of cyclic accelerators in 1948 amounted to 41,923,000 pounds and sales to 25,011,400 pounds, valued at $9,693,800. By chemical classification the total production figure was as follows: Aldehyde amines, 890,600 pounds; Dithiocarbamates, 303,600; Guanidines, 51,150,000; Thiazole Derivatives, 35,578,800. Sales and value of these materials were as follows: Aldehyde amines, 809,900 pounds ($469,100); Dithiocarbamates, 236,600 ($330,200); Guanidines, 4,413,000 ($1,764,400); Thiazole Derivatives, 19,551,900 ($7,130,100).

Production of the thiazole derivatives in 1948 was about 14% less than in 1947, while the production of guanidines was approximately the same. Production of cyclic antioxidants in 1948 amounted to 39,390,300 pounds and sales to 34,846,300, valued at $16,816,700, or a unit value of 48c per pound. Production of these antioxidants in 1947 amounted to approximately 38,000,000 pounds.

Production of acyclic rubber processing chemicals in 1948, including accelerators, antioxidants, peptizers, and other products, amounted to 14,163,500 pounds, somewhat less than the 14,900,000 pounds in 1947. Sales in 1948 totaled 11,359,700 pounds, valued at $9,392,100 or a unit value of 83c per pound.

Production of the acyclic chemicals, for which separate statistics may be shown, included the following: Dithiocarbamates, 864,100 pounds; Tetramethylthiuram Sulfides, 3,140,300, and all other accelerators, 1,855,600.

Although acyclic materials as a group declined slightly in output in 1948, some individual chemicals within the group, especially the acyclic accelerators, increased. As indicated, production of these accelerators totaled 5,860,000 pounds in 1948 as compared with approximately 4,400,000 pounds in 1947.

Rubber Study Group to Meet

The Seventh Annual Meeting of the International Rubber Study Group will be held in Brussels, Belgium, the week of May 2. The synthetic rubber policy of the United States is expected to come in for considerable discussion at the meeting, particularly in view of pending legislation to revise or extend the Rubber Act of 1948.

A.S.T.M. STANDARDS COMMITTEE ACCEPTS NEW RECOMMENDATIONS

Based on actions from numerous technical groups, the American Society for Testing Materials, through its Administrative Committee on Standards, approved many new and revised tentatives during December, 1949. In the interval between annual meetings this committee can review recommendations affecting specifications and tests which have been approved in the technical committees.

Of the numerous actions on standards recommended by Committee D-11 on Rubber and Rubberlike Products three are new tentatives issued for the first time. The new specifications for rubber latex—D-1076—will meet a frequently expressed need for quality requirements in test methods. They were published in the 1949 preprinted report of Committee D-11. Two types are covered: Type I—Centrifuged natural latex preserved only or by formaldehyde followed by ammonia; Type II—Creamed natural latex preserved with ammonia only or by formaldehyde followed by ammonia.

The test for sealing properties of rubber-like materials — D-1081 — is particularly of value in connection with gasketing materials. Originally developed by the Bureau of Ships it is now required in certain Navy standards.

The new methods D-1077 for determining curing characteristics during heating essentially evaluates the scorched properties of rubber compounds. A shearing disk viscometer is the principal instrument described.

Concerning the revisions in various methods for which Committee D-11 is responsible, those in the test for compression set D-395 add a new heating period which has come into wide use. There are now two periods covered—22 hr. at 70°C. and 70 hr. at 100°C.

Modifications in the test of rubber in liquids — D-471 — specify the use of acetone instead of alcohol, and in the test for Battery Condensers D-639 a slight change in procedure will improve the reproducibility of the acid absorption test.

The Durometer Hardness Test D-676 will have its scope broadened, the indentor tolerances changed, and the calibration clarified.

Revisions in the viscosity test D-927 include editorial changes, the definition of the test temperature, and other improvements.

Numerous changes in the tentatives, D-1056 for sponge rubbers and D-1055 for latex foam rubber, were proposed by the technical committee on automotive rubber.

Van Rossem Named 1950 Lecturer

The Institution of the Rubber Industry has named Dr. A. V. Van Rossem, director of the Rubber Stichting (Rubber Foundation) at Delft, Holland, as the 1950 Foundation Lecturer. Dr. Van Rossem, recognized as one of the world's leading rubber technologists, is the first Lecturer selected from outside Great Britain since the Foundation Lecture was instituted in 1946.

Good-rite Alkylated Aromatic

The availability in experimental quantities of a new Good-rite alkylated aromatic amine, not previously described in the literature, has been announced by the B. F. Goodrich Chemical Co. Designated Good-rite, p, p' dioctyl diphenylamine, it is oil soluble and has been designed for uses where a relatively colorless, oil soluble antioxidant is required. Furnished as a light buff-colored crystalline solid, it is soluble in carbon tetrachloride, ethylene dichloride, ethyl acetate, hexane, benzene, acetone and methanol. A data sheet is available upon letterhead request to the Chemical Sales Department, B. F. Goodrich Chemical Co., 324 Rose Building, Cleveland 15, Ohio.

Vinyl Coating Specifications

A proposed Federal specification for a gasoline and water resistant vinyl coating system has been circulated by the Federal Specifications Board. This specification is based on Corps of Engineers "Tentative Specification T-2397-A, Lacquer, Vinyl Resin, Gasoline and Water Resistant." This is the first proposed Federal specification covering a vinyl coating. Copies of the specification as proposed may be obtained from E. F. Hickson, Room 417, Chemistry Building, National Bureau of Standards, Washington 25, D. C.

Cetol Resin-Chemical Intermediate

A new resin-chemical intermediate material which finds varied application in the rubber, plastics, textile, paper and other industries has been developed by Process Chemical Specialties of Beverly, Mass. Called "Cetol," it is described as a blend of organic derivatives secured from the extracts of various vegetable materials. It is a pale yellow-red aromatic liquid, with a boiling point range of 160 to 215° C., and a flash point of approximately 150° F. Cetol can be hydrogenated, hydrated or sulfurized. It forms resinous materials with maleic anhydride, phenols and urea. Various concentrated forms of the material form products with varying characteristics—liquid, paste and solid, some of which find application in rubber formulations.

Johnson and Johnson Expands

Plans to build a new research center in New Brunswick, N. J., to consolidate and expand its present research facilities were announced recently by Johnson & Johnson. With completion scheduled for August, the center will consist of a one-story E-shaped laboratory building and a two-story administrative building. The buildings will have about 50,000 square feet of floor space and will be staffed by 100 to 200 persons.

FIRESTONE PRODUCING RUBBERIZED RADOMES FOR RADAR PROTECTION

This giant mushroom is one the rubberized fabric radomes being made by the Firestone Tire and Rubber Company to protect Air Force radar installations from wind, snow, sleet and ice. It will be mounted atop a 25-foot tower. The balloon-like shelter is held up by a twentieth of a pound of air pressure without any metal or wood supports of any kind, yet the covering is as tight as a drum. Rayon, nylon or fiber glass fabric is covered with rubber to make the outer skin of the giant radome which measures 167 feet in circumference and 36 feet in height. To enter the radome, it is necessary to go through a tunnel with an air lock chamber. When inflated to half a pound of pressure the radome is designed to withstand 125-mile-an-hour winds and, by flexing, will shake off ice and snow from its rounded surface. The entire radome, when deflated, packs into a canvas bag like the one on the army truck in the foreground. General Electric, as prime contractor with the U. S. Air Force, developed the radar equipment that will be protected by the radome.

MANSFIELD TIRE CO. ACQUIRES INLAND'S TIRE-TUBE PRODUCTION

The Mansfield Tire & Rubber Co., of Mansfield, Ohio, has acquired the tire and tube production of the Inland Rubber Corporation of Chicago, Ill., and the manufacture of Inland tires and tubes has been integrated into the production of the Mansfield plant. The transaction was effective on February 25. Mansfield Tire is affiliated with the General Tire & Rubber Co. while Inland Rubber was a subsidiary of the Minnesota Mining & Manufacturing Co.

It was made clear, however, that although Inland's tire and tube production was acquired by Mansfield Tire, the sales offices, personnel and warehousing of the Inland Rubber Corp. will remain in Chicago, and the organization will continue in operation as a separate company. Inland's sales organization is headed by Virgil D. Ober as sales manager.

Inland Rubber was organized in 1913 and experienced a fairly steady growth, with its distribution being in all states east of the Rockies. The Inland line of tires and tubes will be expanded with additional sizes of passenger and truck tires and by the addition of tractor and farm implement tires.

This is the second deal of a like nature which Mansfield has made in recent months. Last July the company acquired the tire and tube production of the Pennsylvania Rubber Co., a wholly-owned subsidiary of General Tire. Mansfield now makes all Pennsylvania tires, although Pennsylvania Rubber operates out of Mansfield as a separate sales company.

Holt Reviews Recent Developments

Recent developments in the rubber industry were reviewed on February 16 by E. G. Holt, Assistant Chief, Rubber Division, Office of Domestic Commerce, in a talk before the Foreign Trade Class at the School of Commerce of New York University. Mr. Holt expects U. S. growth in new rubber consumption to be gradual in the future and unlikely to average higher during 1951-60 than the record figure of 1,122,000 long tons attained in 1947. In connection with natural and synthetic rubber latices, he pointed out that U. S. consumption in 1949 was around 62,000 tons compared with 55,000 tons in 1948, accounting for 6.2% of total 1949 new rubber consumption. Referring to the use of rubber in roads, Mr. Holt said that if all the U. S. roadways hard-surfaced in 1948 had used a seal coat containing ¼ pound of rubber per square yard, there would have been a market for nearly 40,000 tons of rubber. Concerning cold rubber, he said demand had not yet attained 10,000 tons in any month, and the production capacity of 15,000 tons monthly was therefore ample for the present.

U. S. Rubber recently completed a 25,000-foot conveyor belt system at its Passaic, N. J., plant. The belt, shipped in nineteen sections, will be used to modernize coal mining methods in Turkey.

LABOR NOTES

Liberalization of the company-wide pension plan to guarantee 13,000 domestic salaried employees minimum retirement pay of $100 per month including Social Security at age 65 with 25 years of service has been announced by Goodyear. Basic retirement credits will be one-half of one percent of the salaried employee's total pay received during the years of service covered by Social Security, such credits being exclusive of social security benefits.

Negotiations between Goodrich and the U.R.W.A. for establishing improved employee benefit programs for seven plants of the company were concluded on February 17. The improved programs, signed for a five-year period, include continuation of the contributory insured retirement program previously in force, and an increase in retirement benefits of 16⅔ percent to all participants. These benefits are in addition to primary social security.

A number of workers at the Fisk Plant of U. S. Rubber at Chicopee, Mass., walked out on February 22 in protest against "mechanical spies." The company had installed mechanical recording devices to check the rate of work and the men objected to the devices.

U. S. Rubber is taking steps to reduce the seasonal employment problems at its footwear plant in Woonsocket, R. I. Production of several non-footwear items is planned to help level out the employment curves. Among new items under production at the plant are a new type of rubber wading pool featuring rigid walls and a so-called lifting bag, a rubber inflatable airplane jack.

George B. Dryden Retires

After 50 years in the rubber manufacturing business, George B. Dryden retired on December 31, 1949, as vice-chairman of the board and chairman of the executive committee of the Sheller Manufacturing Corp. Mr. Dryden started his business career in 1897 as a salesman of carriage tires and solid tires. He was associated with Kelly, Maus & Co. In 1898 he formed the Imperial Rubber Tire Co. Later, he became Chicago manager of the Rubber Tire Wheel Co. which became the Kelly-Springfield Tire Co., and, subsequently, the Consolidated Rubber Tire Co. In 1901 the Dryden Hoof Pad Co. was formed. This company eventually became the Dryden Rubber Co. with headquarters in Chicago. In 1947, the Dryden Rubber Co. was sold to the Sheller Manufacturing Corp., at which time Mr. Dryden became vice-chairman of the board and chairman of the executive committee. The Dryden Rubber Division of the Sheller Manufacturing Co., with headquarters in Chicago, operates plants at Keokuk, Iowa and Montpelier, Ind. It also operates the Peerless Mold and Machine Division in Chicago. Mr. Dryden was a director of the Rubber Manufacturers Association, Inc. He is now devoting his full time to personal matters.

1949 CASING PRODUCTION DROPS FROM PREVIOUS YEARS' TOTALS

A total of 76,371,514 automotive casings were produced in 1949, according to preliminary estimates of the Rubber Manufacturers Association. In the previous year, 81,314,417 automotive casings were produced. These figures break down to indicate that in 1949, 65,142,607 passenger and 11,228,907 truck and bus casings were produced compared with 1948 when 66,738,436 passenger and 14,575,981 truck and bus casings were produced.

Shipments of automotive casings during 1949 totaled 76,529,727 units, of which 65,066,321 were passenger and 11,463,406 were truck and bus casings. In the previous year a total of 77,781,262 casings were shipped of which 63,540,160 were of the passenger type and 14,241,102 of the truck and bus type.

At the end of 1949 there were 10,650,548 automotive casings on hand compared with the 10,698,225 casings on hand at the end of the previous year. Of the 1949 total, 8,912,866 were passenger and 1,737,682 were truck and bus casings. Of the 1948 total, 8,772,822 were passenger and 1,925,403 were truck and bus casings.

During 1949, 65,563,860 passenger and truck and bus tubes were produced against the 70,032,890 tubes produced the year before. A total of 64,348,854 tubes were shipped in 1949, while 68,499,254 were shipped in 1948. At the end of 1949, there were 10,713,187 passenger and bus and truck tubes on hand compared with the 9,641,238 tubes on hand at the end of the preceding year.

Jago Visits United States

Edward Jago, deputy chairman of the British Rubber Development Board, parent organization of the Natural Rubber Bureau in Washington, D. C., recently spent several weeks in the United States, returning to England on the *Queen Mary* on March 4. Mr. Jago, who has been associated with the rubber industry in Southeast Asia for some 30 years, expressed complete satisfaction with the progress being made by the campaign in this country to promote the market for natural rubber. At a press conference held in New York just prior to his departure, Mr. Jago emphasized the fact that natural rubber is the key to the prosperity of Southeast Asia and that the over-all outlook for natural rubber is now better than at any time since the end of the war. He also predicted that production of rubber in Malaya should approach a peak of 700,000 long tons in 1950.

Dow Cuts Latex Production

The Dow Chemical Co. has announced that production of its butadiene-styrene latex, used as a coating agent, has been temporarily suspended as the result of an explosion and fire which practically destroyed the latex plant at Midland, Mich., during the week of February 13. Company officials stated that the fire involved raw material rather than finished latex. Production will be resumed as quickly as possible.

COMMERCE DEPARTMENT REPORTS ON RUBBER CONSUMPTION IN 1949

Consumption of new rubber, both synthetic and natural, in the United States during 1949, totaling 990,637 long tons, was the fourth highest in history, according to preliminary estimates of the Department of Commerce. For the calendar year, the ratio of consumption of GR-S to natural plus GR-S was 34.2%, a decrease of only 6/10 of 1% from the previous year. Total consumption of new rubber in the United States in 1949 has been exceeded only in the three previous years, 1948, 1947 and 1946. The decline from 1948 (1,069,404 long tons), was 7.4% and the reduction from the all-time high consumption in 1947 (1,122,327 long tons) was 11.7%.

Prior to 1939, the start of hostilities in Europe, peak rubber consumption in the United States was 575,000 long tons, all natural, in 1936. In 1949, U.S. manufacturers consumed 1,584 long tons more natural rubber than during the peak prewar year.

Consumption in 1949, by types of rubber, as compared with the previous year, was as follows: Natural rubber, 576,584 long tons, a decline of 8.1%; GR-S, including imports and high styrene content rubber, 320,878 long tons, off 7.1%; butyl type, including imports, 52,661 long tons, down 10.5%; neoprene, 31,798 long tons, off only 1%; N-type rubbers, 8,716 long tons, up 51%. Use of neoprene and N-type rubbers has been entirely voluntary since February 1, 1946.

Use of Natural Latex

A noteworthy development which stemmed the declining consumption of natural rubber was an increase of 10,061 long tons in the use of natural latex in 1949. A growing demand for foam latex products and consequent stepped-up production accounted for this 35% increase in natural rubber latex consumption. Total use (63,800 long tons) of all latices (natural, GR-S and neoprene), however, was estimated to represent an increase of only about 8,600 long tons.

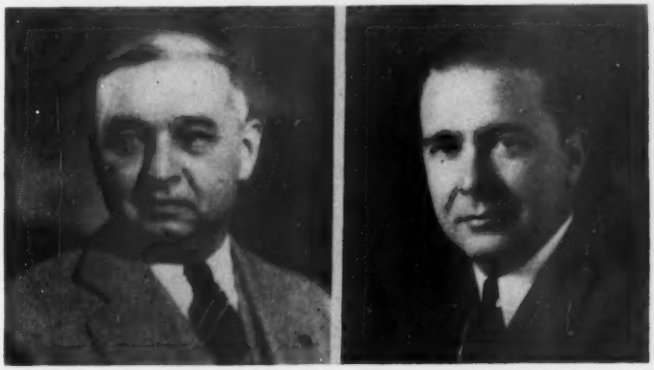
In addition to the new rubber materials mentioned, rubber manufacturers used 222,716 long tons of reclaimed rubber in 1949. This was a decrease of 38,397 long tons, or 14%, from 1948. In terms of percentage of new rubber consumption, use of reclaim was 22.5% in 1949 as compared with 24.4% in 1948, a decrease of only 1.9%. However, the percentage use of reclaim actually increased in transportation items, while it declined sharply in the non-transportation field.

One basic factor in sustaining synthetic rubber consumption in 1949 was a marked change in the types of tires produced. Unit production of passenger car, motorcycle, farm tractor and implement tires declined from 1948 by an average of only 2.6%, but production of truck and bus tires fell 22.8% during 1949. GR-S consumption in the first group of tires is about 6 times greater than in truck and bus tires. A second factor was that the output of camelback, which is about one-half GR-S, was up 27% for the year.

Production of all types of synthetic rubber in 1949 totaled 393,690 long tons as against 488,343 long tons in 1948, a decline of 19.4%. Production of Government GR-S, which totaled 288,882 long tons, was off 26% from the previous year.

The stock position of natural rubber available to industry (held by consumers and dealers in the United States) deteriorated 26% during 1949, falling from 141,541 long tons on December 31, 1948, to 105,039 long tons at the end of 1949. Stocks touched a low of 90,733 long tons at the end of October, only 1.8 month's supply at the then rate of consumption. The stock position of natural rubber latex was extremely short on December 31, 1949—4,696 long tons, or 1.2 months' supply, compared with 11,235 long tons at the end of 1948, which represented a 4.6 months' supply at the then rate of consumption.

LEE RUBBER & TIRE ANNOUNCES APPOINTMENT OF NEW EXECUTIVES



O. S. Dollison E. M. Ikert

O. S. Dollison, formerly vice-president and general manager of the Republic Rubber Division of the Lee Rubber & Tire Corp., has been named vice-president of the parent corporation, with headquarters in Youngstown, Ohio. E. M. Ikert, formerly assistant treasurer of the Republic Rubber Division, has been appointed general manager of that division.

United Engineering Expanding

United Engineering & Foundry Co., of Pittsburgh, Penna., has announced an expansion program which will soon begin at its Canton, Ohio, plant, which will add about 12,500 square feet to their present machine shop and shipping facilities. The cost of the entire project is estimated between $600,000 and $700,000 and will include the purchase of some new machine tools. The new facilities will be devoted mainly to grinding and other finishing operations on large rolls used in the rubber, paper and other industries. The new building is expected to be completed for operation within nine to ten months. This addition, coupled with a modern research laboratory recently completed at a cost of about $125,000, is said to make the Canton plant one of the best equipped iron foundry and roll manufacturing plants in the world.

Appointments at Edgar Brothers

Alfred G. Blake, formerly partner in Rogers & Slade, management consultants of New York City, has been appointed vice-president in charge of sales for Edgar Brothers Co., Metuchen, N. J., producers of filler clays and special inerts and pigments for the rubber and other industries. Mr. Blake is a graduate engineer of Lehigh University, class of 1925. In addition to his five years with Rogers & Slade, Mr. Blake spent the war years from 1942 to 1945 as director of operations for training within industry of the War Manpower Commission. During this period he was on loan from the Rudd Manufacturing Co. of Pittsburgh, Penna., where he had served in various capacities for several years. At the same time, J. Gilbert Mason, Jr., who has been associated with Edgar Brothers for over 30 years, was elected vice-president. He will continue as a member of the board of directors. O. W. Callighan, a veteran of over 20 years' service in the company's Sales Department, was promoted to manager of special accounts. Robert V. Dilley was named manager of specialty sales and assistant treasurer of the company.

Makes Offer for Norwalk Tire

The Acme-Hamilton Rubber Co., which operates mechanical goods plants in Trenton, N. J., and which has headquarters in New York City, has offered to buy the Norwalk Tire & Rubber Co. for $2,000,000, plus stock, according to Wallace De Laney, trustee for the tire company, which has been operating in receivership since last May. Mr. De Laney said the offer was considered the most satisfactory of several received to date. A hearing on all plans for reorganization of Norwalk Tire is scheduled to be held in New Haven on March 20.

AKRON HEARS HESTON AND COMES DISCUSS NEW RUBBER MACHINERY

Approximately 600 members and guests of the Akron Rubber Group attended the symposium on extruding and mixing equipment for the rubber industry held on February 3 at the Mayflower Hotel in Akron, Ohio. Principal speakers at the symposium were Donald A. Comes, assistant general sales manager of the Farrel-Birmingham Co., Inc., Ansonia, Conn., and Allen L. Heston, vice-president of the National Rubber Machinery Co., Akron. Mr. Comes spoke on "Rubber Mixing Machinery," while Mr. Heston chose as his topic "Rubber Extruding Machinery." Each of these talks was followed by a panel discussion in which the questions of the audience were answered by George L. Bruggemeier (Firestone), Paul Beebe (Goodyear), A. W. Phillips (General), Robert L. Wattleworth (Goodrich), and Pat Fay (U. S. Rubber).

Extruder Performance

In his address, Mr. Heston listed eleven conditions affecting extruder performance and then discussed the conditions which are directly dependent on the machine. These include type and style of die head used; temperature of cooling and heating medium available; screw clearance in cylinder; thrust bearing and drive; screw and cylinder characteristics and dimensions; and size, contour and location of the feed hopper.

The speaker stated that an extruder should never be considered as a universal machine. Instead, the cylinder and feed screw which are the heart of the machine should be selected for the specific job they are supposed to do. He also stressed the importance of determining the extrusion characteristics of the compound to be run before selecting a specific type of machine for production. GR-S and GR-I each require modification of the feed screw, he said, and recently it has been found that cold rubber is best extruded with still another type of screw, usually of depressing pitch and chrome plated or of stainless steel.

Direct Strip Feeding

Strip feeding directly from a warming mill instead of hand feeding was recommended in order to obtain uniform extrusion. Mr. Heston stated that an ideal feed condition is obtained by supplying a strip of proper cross section at a speed very slightly less than the peripheral speed of the base of the feed screw. In this way the strip is wound under the root diameter of the screw continuously and is not cut off intermittently.

Where great accuracy of the extruded strip is required, Mr. Heston suggested a screw with slightly decreasing pitch. If considerable variation can be tolerated, greater production can be obtained from the same machine by use of a single flight, uniform pitch screw with double flight for only about 1½ turns at the head end.

The latest type of tuber, fitted with a special cold feed cylinder and screw was described by the speaker. He said this is particularly suitable for segregated departments of large plants or for small mechanical good plants where warm-up mills or Banburys are not available and stocks are received cold from outside sources.

At a short business meeting following the technical meeting, Roy Marston (Binney & Smith), chairman of the Nominating Committee, presented the following slate for the 1950-51 term: *Chairman,* E. L. Stangor (DuPont); *Vice-Chairman,* Dale F. Behney (Goodyear), and J. Boyd Cook (Wooster Rubber); *Secretary,* Lawrence M. Baker (General Tire) and Reed Schild (Seiberling Rubber); *Treasurer,* Robert D. Juve (Mohawk), and Irvin J. Sjothun (Firestone). A proposed change in the by-laws authorizing the group to have both a secretary and a treasurer was passed.

Following the serving of a dinner, the group enjoyed a showing of the moving pictures of the Ohio State-California Rose Bowl game accompanied by a running commentary by Jack Fullen, alumni secretary of Ohio State.

Synthetic Rubber Data

According to the 1947 Census of Manufactures, 20 establishments were engaged in the manufacture of synthetic rubber in 1947, employed an average of 7,663 workers for the year, spent $137,844,000 for materials, fuel, electricity and contract work, and shipped products for a total value of $235,200,000. The value added by manufacture in the year amounted to $97,356,000.

Russian Journals Available

Complete English translation of the *Journal of Applied Chemistry of the USSR* will be available to American research laboratories and libraries, beginning with the January, 1950 issue, Consultants Bureau, 153 West 33 street, New York 1, N. Y., has announced. Subscribers to the English translation will receive complete translation of each 1950 issue within 7 weeks after its arrival in this country, and several months in advance of the abstract literature. Subscription to the entire Vol. 23 (1950) of the *Journal of Applied Chemistry of the USSR* in English translation is $80.00. *The Journal of Applied Chemistry of the USSR* will be translated simultaneously with the *Journal of General Chemistry of the USSR,* which Consultants Bureau is also publishing in English translation. The January, February, March, April and September (1949) issues of the latter journal are already available in English. Subscribers to the Consultants Bureau English translation of the *Journal of General Chemistry of the USSR* will receive all 1949 issues by June 30, 1950, and all 1950 and subsequent issues within eight weeks after receipt of each issue in the United States. Annual subscription to the *Journal of General Chemistry of the USSR* in English translation is $95.00.

CHASE ADDRESSES BUFFALO GROUP ON RUBBER MACHINERY ADVANCES

The February 27 meeting of the Buffalo Rubber Group held at the Hotel Westbrook in Buffalo, N. Y., was addressed by Donald C. Chase, manager of the Rubber and Plastics Division of the Farrel-Birmingham Co., Inc., Ansonia, Conn. Mr. Chase spoke on the subject, "Advances in Heavy Rubber and Plastics Machinery." His talk was similar to one he previously delivered before the American Society of Mechanical Engineers in Erie, Penna., last September.

In his address, Mr. Chase reviewed the latest designs of heavy machinery for processing rubber and plastics, pointing out that speeds, production and power requirements are being increased and greater attention is being given to reduction of wear and maintenance. He stressed the importance of gauge control in calendering and discussed various methods of overcoming roll deflection including the crossed axis Z-type calender and calenders with rolls of very large diameter.

Mr. Chase noted that a recent design feature is the removal of gears from the machine and enclosing them in a separate gear unit, where they are not affected by heat and stresses created by the working elements of the machine.

Another trend, he said, is towards the use of extruders, strainers and pelletizers to receive stock directly from a Banbury mixer, without a sheeting mill, resulting in labor savings, greater cleanliness and more uniform products. Screw type machines have also been developed in the larger sizes for the continuous processing of certain types of plastics.

National Acquires Reynolds Wire

National-Standard Co. of Niles, Mich., has acquired for cash all the outstanding capital stock of the Reynolds Wire Co. of Dixon, Ill. The Reynolds firm makes fine wire, wire cloth and meshes for automotive, aviation, marine, farm implement, building and other industrial application at plants in Dixon. For the present, National-Standard intends to operate Reynolds as a wholly-owned subsidiary. Reynolds Wire Co. reported net earnings of $516,864 for the fiscal year ended June 30, 1949.

Quebec Group Holds Annual Dance

The Annual Dance of the Quebec Rubber and Plastics Group was held on February 10 at the Royal Mount Hall in Montreal, Que., Canada. A number of valuable door prizes, contributed by local firms associated with the group, were distributed to the members and their guests. The next meeting of the Quebec Group is scheduled for March 23 in Montreal.

Buffalo Changes Meeting Place

The April 4 meeting of the Buffalo Rubber Group, originally scheduled to be held at the Hotel Westbrook, Buffalo, N. Y., has been shifted to the Elks Temple, 207 Delaware Avenue, Buffalo 2. The meeting program has not been decided upon as yet.

BOYS ADDRESSES ONTARIO GROUP ON NAVAL STORES USE IN RUBBER

A meeting of the Ontario Rubber Section of the Chemical Institute of Canada was held on February 14th at Hart House at the University of Toronto, Toronto, Ont., Canada. The meeting was addressed by C. H. Boys of the Naval Stores Department, Hercules Powder Co., Wilmington, Del.

Mr. Boys spoke on "Naval Stores in the Rubber Industry." He traced the origin of the naval stores industry in the United States to the Jamestown, Va., colony 342 years ago, and explained the term "naval stores" as pinewood chemicals. He defined such products and briefly summarized production methods in each of the four producing branches of the naval stores industry — gum naval stores, solvent extraction, destructive distillation, and pulp mill recovery.

Mr. Boys stressed the value of rosin because of its abundant supply and relatively low cost. He also discussed the chemical nature and types of modification possible with the versatile pinewood derivative. He mentioned the important development of stabilized rosin soaps used in the production of GR-S-10 and cold rubber. He also outlined the use of rosin and special pinewood resins as well as other naval stores chemicals such as pine tar oils, pine tars, pitches and terpenes in the compounding and reclaiming of various rubbers.

The speaker emphasized the part research and development have played in the naval stores industry to improve existing materials and create new products from primary pine-tree chemicals. He also spoke of the function of the naval stores industry as a large producer of basic raw materials which find considerable application in the rubber trade.

Resumes Private Law Practice

Peter Guy Evans, an original member of the Excess Profit Tax Council of the Bureau of Internal Revenue, has resigned to return to the private practice of law. Mr. Evans, a member of the New York and Federal bars, and a C.P.A. of New York and New Jersey, will make his headquarters at 46 Cedar St., New York, where he will specialize in Federal and state tax matters. While with the Bureau of Internal Revenue Mr. Evans handled many rubber industry claims.

Chicago To Hear Bridgwater

The March 24 meeting of the Chicago Rubber Group to be held at the Morrison Hotel in Chicago, Ill., will be addressed by E. R. Bridgwater, director of sales for the Rubber Chemicals Division of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., and Wayne Griffin, supervisor of the personnel office of the Electro-Motive Division of the General Motors Corp., Detroit, Mich. Mr. Bridgwater will speak on "Synthetic Rubber Looks Into the Future." Mr. Griffin will speak on "This is Our Problem."

Named Service Department Head

Dr. Edward F. Wagner

Witco Chemical Co. has announced the appointment of Dr. Edward F. Wagner as head of the recently reorganized Technical Service Department at 6200 West 51st St., Chicago 38, Ill. Dr. Wagner received his training in chemical engineering at the Illinois Institute of Technology and spent a number of years in the petroleum industry. He has been with Witco for the past five years in various executive capacities. Six departments have been set up in the Technical Service Laboratory to handle problems on the various products manufactured by the company including metallic stearates, paint driers, asphalts, rubber raw materials, mastics, and a general department to handle vinyl stabilizers, waxes, etc.

CONNECTICUT HEARS GREENHALGH DISCUSS PLASTICS PROCESSING

Approximately 140 members and guests attended the February 17 meeting of the Connecticut Rubber Group held at the Stratfield Hotel in Bridgeport, Conn. Principal speaker of the evening was Milt Greenhalgh, who spoke on "Processing of Plastics." Memory expert Robert H. Nutt also addressed the group on "A Better Memory Pays."

Mr. Greenhalgh's address was a general discussion of the processing problems in molding, extruding and calendering of plastics. He said that it is important for rubber men to keep an open mind in designing plastic processing equipment where all former experience has been with equipment designed for handling rubber and like polymers. Rubber equipment has basic design principles, he noted, in some cases far removed from processing equipment best suited for plastics.

The speaker briefly described some of the differences in calender and tuber design necessary because of the difference in processing temperatures between rubber and plastics. Those who deal with copolymers of rubber-like material and plastics are in a design position some place between. At the conclusion of Mr. Greenhalgh's address, an open discussion period was held.

NEW YORK RUBBER GROUP WILL AGAIN SPONSOR ESSAY CONTEST

At a meeting of the Executive Committee of the New York Rubber Group held on February 15, it was decided to have the group again sponsor a Prize Essay Contest similar to those conducted in 1939, 1940 and 1941. Chairman D. E. Jones (American Hard Rubber) appointed the following committee to handle the details of the new contest: T. A. Bulifant (Barrett), chairman, Sherman R. Doner (Manhattan Rubber), and Edward N. Cunningham (Enjay). Details of the contest will be supplied to the full membership shortly.

The committee also adopted dates for the 1950 meetings as follows: Spring Meeting, April 28; Fall Meeting, October 20; Christmas Party, December 15. All meetings will be held at the Henry Hudson Hotel in New York City. In addition, an outing will be held in mid-June and a golf tournament early in August. Pete Murawski (DuPont) was named chairman of the Outing Committee. Dates for these affairs will be announced later.

The Executive Committee also approved a change in the election procedure. In the future, officers for the coming year will be elected at the Fall rather than the Christmas meeting, but all officers and members of the Executive Committee will hold office until the end of the current year, with the officers elected at the Fall meeting taking office on the following January 1.

Minnesota Mining Expansion

Minnesota Mining & Manufacturing Co., St. Paul, Minn., has purchased 26,000 square feet of additional office and warehouse space in Detroit, Mich. Two buildings and nearly four acres of land are included in the property. The company presently operates an adhesives and coatings plant at 411 Piquette Avenue which also houses the Detroit branch sales office and warehouse facilities. Moving the branch unit to the new quarters at 8825 Grinnell Avenue will make more manufacturing space available in the adhesives plant. One new structure, containing approximately 22,000 square feet of floor area, will house the branch offices and serve as a warehouse. A smaller building will provide additional storage space. Both are of brick and steel construction. The company paid $185,000 for the property.

Pio-Con Mold Lubricant

Pio-Con, a new mold lubricant with an organo-silicone base, has been introduced by Pioneer Products, Inc., 5224 Fairlawn Ave., Baltimore 15, Md. It is described as an emulsion that glazes hot surfaces to give easy release from curing molds and a high gloss finish on slabs. Features of Pio-Con claimed by the producers include instant, smooth release; dry, non-tacky finish; non-staining; non-blocking, and scorch and heat resistance. One gallon of the material will make up to 50 gallons and more of stock solution. Sales representatives handling Pio-Con include Tanney-Costello, Inc., of Akron, and H. M. Royal, Inc., of Trenton.

KEMP SPEAKS ON COMPOUNDING FOR ELECTRICAL PROPERTIES

A. R. Kemp, consulting chemist of 4218 East First St., Long Beach 3, Calif., addressed the February 7 meeting of the Los Angeles Rubber Group held at the Mayfair Hotel in Los Angeles, Calif. Mr. Kemp spoke on "Compounding Rubber for Electrical Properties." He noted that the manufacture of insulated wires and cables provides the most extensive and important use of rubber for electrical insulation. Minor applications are in hard rubber insulation, electricians' gloves, insulating tapes and protective mats.

Natural rubber has lost much of its pre-war position in the wire and cable industry to GR-S and neoprene which on merit have retained a large part of their wartime use as insulation and jacket or protective material, respectively. Butyl rubber shows promise as a power cable insulation. Polyethylene is providing the need for a high frequency insulation on coaxial cables. Plasticized polyvinychloride also is a widely used covering on a large segment of wires and cables.

Compounding Insulations

The compounding of insulations for wires now extends from natural rubber to include numerous synthetic elastomers and plastic materials. It therefore requires a very critical selection of materials and processing methods to furnish insulations to meet the diverse electrical requirements of the electrical industry and to provide adequate long life performance under varied service conditions.

The electrical properties of insulating materials were discussed and their relative importance indicated depending on the electrical service involved. These characteristics are the dielectric constant or the specific inductive capacity, A. C. conductivity (power factor) D. C. resistivity and dielectric strength or breakdown voltage. The effect of choice of polymer and compounding ingredients on the dielectric properties of the final insulation were outlined. The adverse effect of moisture on the dielectric properties of insulations was pointed out.

Aside from electrical requirements a long list of physical, mechanical and chemical requirements must be satisfied for the insulation needs of the many designs and types of wires and cables used. Severe performance requirements must be met in some cases in wet locations and in others under severe weather exposure. In special cases high ozone concentration may surround the insulation and cause cracking and in others the service may require operation at high temperatures. In any case the choice of insulation composition will depend upon the conditions imposed in service.

As regards processing developments in the wire and cable industry, the introduction of the high speed continuous vulcanization (C.V.) process has had a revolutionary effect on the manufacture of rubber-covered wire and resulted in major improvements in the product. Extensive investigations have been conducted in the field of specialized testing of wire insulations. These include: water absorption and diffusion studies; effect of moisture on dielectric stability; aging studies, involving the effect of heat, light, oxygen, and ozone; the effect of low temperatures on flexibility and embrittlement; compression resistance testing to determine resistance to cutting. These are a few of the important studies which have led to the introduction of special testing procedures used in the wire and cable field to control and improve the product.

Guayule in Turkey

According to reports reaching the U. S. Department of Agriculture, scientists in Turkey have made great strides in successfully cultivating and processing guayule rubber. No information as to methods or costs has been determined, but the reports indicate that Turkey has practically ceased the importation of natural rubber and is utilizing its home-grown guayule. Efforts are being made to secure further details.

Chicago Group Hears Dinsmore

The February 17 meeting of the Chicago Rubber Group held at the Morrison Hotel in Chicago, Ill., was addressed by Dr. R. P. Dinsmore, vice-president in charge of research for the Goodyear Tire & Rubber Co. In his address, entitled "Where Do We Stand," Dr. Dinsmore said the rubber industry is facing a technological crisis because of a shortage of young trained technicians. Dr. Dinsmore said that, chiefly due to the war years when the rubber industry was cut to a low level of operation, many of its technical men went either into the armed forces or entered other lines of manufacture. Many organizations find themselves with a group of undertrained young men and at the other end of the scale a group of aging and overworked executives. The speaker stated that a solution lies in the recognition by management of the problem and its importance, and resourcefulness in creating methods by which younger men, as they prove themselves, may be advanced to positions of greater responsibility.

Organize Jasper Rubber Products

Jasper Rubber Products, Inc., has been organized at Jasper, Indiana, for the manufacture of molded and extruded rubber products. Among products to be made will be rolls, plumbers' suppliers, washers, shock pads, and other industrial specialties. The plant, which has approximately 11,000 square feet of floor space, will employ about 100 when in full operation. Equipment is now being installed and initial production is scheduled for April 15. Clarence Geisler is president of the company and Albert M. Place, formerly associated with the Plabell Rubber Products Co. of Toledo, Ohio, is general manager.

D'IANNI ADDRESSES DETROIT ON BUTADIENE-STYRENE COPOLYMERS

The February 24 meeting of the Detroit Rubber and Plastics Group, held at the Detroit-Leland Hotel in Detroit, Mich., was addressed by James D. D'Ianni of the Research Department of the Goodyear Tire & Rubber Co., Akron, Ohio. Mr. D'Ianni spoke on the subject "Butadiene-Styrene Resinous Copolymers."

Mr. D'Ianni stated that butadiene-styrene resins have become of major importance to the rubber and plastics industries in the last five years as a result of a plentiful and cheap supply of monomers from the synthetic rubber program. Their production and use became established during the war when derivatives of natural rubber (cyclized, chlorinated, etc.) could not be produced.

He reported on polymerization studies, and noted the differences in comparison with the GR-S system, such as faster rate of polymerization and lower modifier requirement. The physical properties of the commercial resins were described. The speaker also discussed effects of the butadiene-styrene charge ratio on these properties.

Compounders use these resins in rubber stocks to obtain reinforcement and other desirable properties, Mr. D'Ianni noted. Properties of natural rubber, GR-S and other synthetic rubber stocks containing various amounts of these resins were fully discussed. Impact-resistant blends are obtained by using large amounts of resin with a small amount of rubber, he said. Applications of these two types were mentioned.

Mr. D'Ianni said that certain styrene resins are very useful in solution applications. One type (Pliolite S-5) is used in paints where chemical resistance is required. Another type (Pliolite S-7) makes excellent paper coatings of low moisture vapor transmission rate and excellent heat sealability, he said. Latex applications were also discussed, such as water-base paints for cement type surfaces and interior walls.

Forms International Section

Koppers Co., Inc., Pittsburgh 19, Penna., has announced the establishment of an International Sales Section to manage and coordinate sales of the company's products and "know-how." Offices of the new section will be headquartered in the company's general offices in Pittsburgh. The new section, which includes the offices of the international development manager and international sales manager, will function as a unit of Koppers Central Sales Department under the direction of Fred C. Foy, vice-president and manager of that department. S. C. Whitehouse, former manager of export sales for Koppers Chemical Division, has been appointed international sales manager. Pending the appointment of an international development manager, this phase of the activities of the new section will be handled by Dr. W. C. Rueckel, manager of export sales for the Engineering and Construction Division.

FTC TIRE DISCOUNT HEARINGS END IN CLASH OVER PROCEDURE

The Federal Trade Commission's tire discount hearings held in Washington, D. C., were concluded on February 18 in the midst of a clash between tire company attorneys and the commission's top anti-monopoly aide. The tire company attorneys demanded further time to rebut opposition testimony and confront their adversaries in give-and-take argument. Everett MacIntyre, chief of the FTC anti-monopoly trials, advised the commission that the tire companies "are not entitled to further hearing."

Mr. MacIntyre argued that all but one of the attorneys failed to follow the procedure for applying for more time as set forth in the commission's written notice of hearings. The sharp exchange was precipitated when Chairman Lowell T. Mason announced adjournment of the hearing and said the commission will decide later whether to take rebuttal testimony before deciding on a discount limit rule.

Manufacturers' Excises Cited

At earlier hearings, the Rubber Manufacturers Association asked for the reduction of manufacturers' excises on tires and tubes to half the present rate. Testifying before the House Ways and Means Committee, Charles W. Halligan, assistant secretary of the association, came out strongly for adoption of HR 6898 which would roll back the tax rate to the 1941 levels.

The National Association of Independent Tire Dealers repeated its charge that the "mass distributor is given a price advantage which he uses to shut out the independent dealer from the market." NAITD asked the commission to adopt a rule limiting discounts to the first $600,000 of replacement tires and tubes bought by a tire outlet in a year. The commission's proposed rule, NAITD said, limiting discounts to a 20,000 pound carload, "would harm the small dealer, who is not in a position to buy by the carload yet might justifiably have claim to some volume differential."

Attorneys for the "Big Four" argued that wholesale price differentials are justified since wholesalers relieve the tire makers of many distribution duties. It was further argued that the proposed trade rule would confuse the relationships between the makers and the sellers of tires.

Montgomery, Ward & Co. also urged the FTC to dismiss its attempt to assess the need for limiting the quantity of replacement tires and tubes on which manufacturers can grant discounts. Ward attorneys said the imposition of a quantity discount limit would "equalize prices to all distributors and raise tire prices."

An interesting bulletin on its various continuous gages, including its new beta ray continuous gage, has been issued by Pratt & Whitney, West Hartford 1, Conn. These instruments are used for measuring the thickness of various materials, such as thin plastics, rubber, glass, asbestos, etc.

Heads New Calco Department

B. W. Henderson

B. W. Henderson, manager of the Rubber Chemicals Department of the Calco Chemical Division of the American Cyanamid Co., has been named manager of the Intermediate and Rubber Chemicals Department of the division. Mr. Henderson, identified with the rubber industry since 1906, came to the American Cyanamid Co. in 1934 as manager of the Rubber Chemicals Department, and in 1947 became manager of the Calco Rubber Chemicals Department. He was formerly vice-president of F. R. Henderson & Co., and from 1924 to 1933 was president of Bancroft W. Henderson & Co., rubber importers. Mr. Henderson is past chairman of the board, Rubber Trade Association, an associate member of the Rubber Division of the American Chemical Society, and a member of many technical and fraternal societies.

Millmaster Named Sales Agent

Willsboro Mining Co., Inc., Willsboro, N. Y., has appointed Millmaster Chemical Corp., 420 Lexington Avenue, New York 17, N. Y., exclusive agent for the sale of Wollastonite, a calcium metasilicate, and Diopside, a calcium magnesium metasilicate. According to Millmaster, interesting and economical uses for Wollastonite are being developed in the rubber, paper and other industries. Willsboro recently completed the construction of a beneficiating plant in order to make commercially available unlimited quantities of various grades of multi-purpose industrial silicates.

Hexagon-Based Football Cleat

Production of a new modern hexagon-based speed cleat for football shoes has been announced by the Wright Manufacturing Co., Houston, Texas. The new design is expected to cut minutes off the time consumed in replacing cleats on shoes. The result of a nation-wide survey of football coaches, the new cleat is quickly screwed on or off with an ordinary light wrench. Wright Manufacturing is reported to produce about 20,000,000 cleats a year.

SCRAP RUBBER INSTITUTE HEAD OPTIMISTIC OVER 1950 PROSPECTS

According to Henry M. Rose, of H. Muehlstein & Co., Inc., and president of the Scrap Rubber Institute of the National Association of Waste Material Dealers, Inc., New York, N. Y., the pricewise position of scrap rubber for the first half of 1950 is good. Mr. Rose commented upon the general condition of the market during the past year and on prospects for the 1950 season in his year-end summary issued recently.

Mr. Rose noted that slightly heavy inventories of scrap rubber were again in evidence in the forepart of 1949 due, in part, to a temporary decline in consumption of reclaimed rubber as well as the remains of a war inventory. In addition to the anticipated decline in reclaim consumption, a general policy of reducing raw material inventories was current with most factories. This brought about an abstinence from purchasing on the part of most reclaimers, with the resultant weakening of the market pricewise.

Additional purchasing came into the market in the last quarter and although it did not bring about any increase in prices, it did bring an underlying strength to scrap rubber prices. Adjustments in manufacturing technique has to a large extent brought a very selective interest into the picture, creating substantial demands for certain grades that were not available in quantity. This tendency must of necessity remedy itself by further adjustments in recipes on the part of the various rubber reclaimers.

Increased Freight Rates

Substantial increased freight rates on scrap rubber during the period of the past few years have gradually narrowed the available territory for supplying scrap rubber. Any increased demand for raw material must of necessity broaden the available supply so that pricewise the position for the first half of 1950 is optimistic. Present market prices do not allow for any source of raw material over approximately 200 miles from consuming area. For the mill to be assured of a continual flow of scrap, either prices must be increased or freight rates substantially reduced, he concluded.

Booklet Keynotes Anniversary

To observe the 40th anniversary of the Bakelite Division of the Union Carbide & Carbon Corp., New York 17, N. Y., a compact history of the division has been published in a special edition of the *Bakelite Review*. This issue cites examples down through the years of the important roles plastics have played in the development of many industries. It also recounts the places which plastics have assumed in the past two decades at home, in wearing apparel, packaging and similar uses. Photographs show the extensive Bakelite plant facilities and intricate equipment required for the large-scale production of plastics. The issue concludes with a summary of the major developments in Bakelite and Vinylite plastics during 1949.

NAMES IN THE NEWS

DEWEY RAINVILLE, previously a sales engineer for the Sterling Electric Motor Co., has been appointed sales manager of Ball & Jewell, Inc., Brooklyn 22, N. Y.

SCHUYLER V. JENKINS, formerly associated with E. I. du Pont de Nemours & Co., Inc., has joined Sprout, Waldron & Co., Inc., Muncy, Penna., as sales representative for New York State.

RALPH C. PERSONS, associated with the Sun Chemical Corp., since 1944, has been elected a director and vice-president of the company.

R. M. JUNKER, associated with the Goodyear Tire & Rubber Co. since 1942, has been appointed manager of the Industrial Roll Sales Department succeeding ERNEST PETERSON who has retired.

L. J. VENUTO, research director of the Binney & Smith Co., New York, N. Y., recently delivered a talk on carbon black before the paint technology class of the Toronto Paint and Varnish Production Club at Toronto, Canada.

LOUIS MOHN, formerly district manager in Pittsburgh, Penna., for the Garlock Packing Co., Palmyra, N. Y., has been appointed to the newly-created position of general sales manager of the company.

HARRY B. MCCLURE, vice-president of the Carbide and Carbon Chemicals Division of the Union Carbide and Carbon Co., will be the first recipient of the Commercial Chemical Development Association Honor Award at a banquet at the Hotel Roosevelt in New York City on March 22.

GEORGE A. DAUPHINAIS, previously plant manager of the Pittsburgh, Penna., plant of the H. K. Porter Co., has been appointed works manager of the Quaker Rubber Corp., Philadelphia, Penna., a newly-acquired Porter division.

JOHN W. THOMAS, honorary chairman of the Firestone Tire & Rubber Co., has been awarded honorary membership in the American Institute of Chemists.

WILLIAM A. MUNKACSY, president of Poly-Cylo Products Co., has been elected president of Munray Products, Inc., sales division of Poly-Cyclo, in Cleveland, Ohio.

DR. FRANKLIN T. PETERS, associated with the Glyco Products Co. since 1947, has been assigned to the newly-formed Development Department of the company.

JOHN HENDERSON, formerly associated with the Norwalk Tire & Rubber Co. and the MB Manufacturing Co. of New Haven, Conn., has joined the Bond Rubber Corp., Derby, Conn., as chief chemist.

WILLIAM L. KEADY, formerly president of the United States Gypsum Corp., has been named president and general manager of the Marathon Corp., effective April 1, succeeding D. C. EVEREST, who will continue in an active capacity as chairman of the board.

W. F. WRIGHTNOUR, associated with the U. S. Rubber Co. since 1940, most recently as manager of business development and merchandise manager of the U. S. Royal Tires Division, has been named director of training of the Tire Division.

LUDWIG C. BOOS, president and general manager of the U. S. Rubber Export Co., Ltd., New York, N. Y., has been appointed chairman of the Rubber Division of the New York Cancer Crusade for 1950.

M. K. SMITH, associated with the Baker Castor Oil Co. since 1941, most recently as director of chemical development, has been named director of the technical division of the company in charge of all technical activities except engineering and agronomy.

ARTHUR L. SNYDER, formerly associated with Burlington Mills as technical manager of the Flat Goods Corp., has joined the Synthetic Fibers Department of the Carbide and Carbon Chemicals Division of the Union Carbide and Carbon Corp. At the same time, ROBERT W. GAINES, former assistant department head of yarn development in Union Carbide's South Charleston, W. Va., plant, was appointed technical representative with the Synthetic Fibers Department.

E. W. LUTZ, associated with the General Tire & Rubber Co. for 19 years, has been appointed credit manager of the company.

CLINTON B. MCKEOWN, associated with the B. F. Goodrich Co. since 1937, since 1942 as a technical staff representative of Goodrich Chemical, has been appointed manager of the Raw Materials Inspection and Development Department of the parent company succeeding WILLIAM L. CARPENTER who has been transferred to the Tire Division on special assignments.

L. GRIESENBECK, for the past three and one-half years associated with the Singapore plant of the Goodyear Tire & Rubber Co., and previously with the Rubber Reserve Co. in New York, has joined Sniffen, Arnold & Co., New York, N. Y.

DR. JOHN H. LUX, formerly director of research for the Witco Chemical Co., has been appointed manager of the New Product Development Laboratory of the Chemical Department of the General Electric Co., Pittsfield, Mass., succeeding DR. J. J. PYLE, who is now engineering manager of the Laminated and Insulating Materials Division in Coshocton, Ohio.

Marvel Awarded Gibbs Medal

The Willard Gibbs Medal, one of the highest honors in American Science, has been awarded to Professor Carl Shipp Marvel of the University of Illinois by the Chicago Section of the American Chemical Society. The award, conferred annually by the section, will be presented to Dr. Marvel at a dinner on May 19. The 1950 medalist, who is head of the Department of Organic Chemistry in the University of Illinois, directed an important part of the World War II research on synthetic rubber. He also served from 1944 to 1946 as chairman of the National Research Council's Panel on Synthesis of Antimalarial Drugs and as a member of the Board for the Coordination of Malaria studies. Dr. Marvel is also known for major contributions to the development of plastics of the vinyl polymer type, particularly those used in the production of transparent aircraft pieces, as rubber substitutes, and as thickening and blending agents in the chemical manufacturing industry.

J. E. O'CONNER, formerly associated with the Pliotherm Sales Department of the Goodyear Tire & Rubber Co., has been appointed manager of the Packing and Special Products Sales Department, succeeding W. F. ONG who has been appointed manager of the Wringer Rolls Sales Department.

R. E. FLATOW, formerly assistant vice-president of the Hardesty Chemical Co., has been appointed assistant sales manager of Brazil Oiticica, Inc., New York, N. Y., for the sale of oiticica and castor oils.

RICHARD S. WHARTON, formerly vice-president in charge of sales of the Quaker Rubber Corp., has joined Hewitt-Robins, Inc., as sales manager of the Hewitt Rubber Division. He will maintain headquarters in New York.

DR. L. KERMIT HERNDON, professor of chemical engineering at Ohio State University, has been appointed director of research for the Mathieson Chemical Corp. He will continue to hold his university post while completing graduate research assignments and supervising Mathieson's University Research Foundation project.

W. E. BLACKMER, who has been associated with the New Jersey Zinc Co. for several years in the sales department, has been appointed Eastern District Sales Manager of the Pigment Division, succeeding the late JAMES P. DUNPHY. He will have his headquarters in New York.

PAUL VAN CLEEF, one of the founders of Van Cleef Bros., Inc., Chicago, who has been serving as vice-president and secretary since the company was acquired by the Johns-Manville Corp., has severed connections with the company. He is currently residing in Los Angeles.

Holt Receives Merit Award

Everett G. Holt, who entered government service in 1917 and was transferred to the Department of Commerce in 1921, has been awarded the department's Silver Medal for Meritorious Service "for many years of outstanding accomplishment in the field of international rubber statistics, their analysis, interpretation, and presentation." The award was presented to Mr. Holt by Charles Sawyer, Secretary of Commerce, at special services in Washington, D. C., on February 14.

Born in Clinton, Maine, Mr. Holt has been in continuous service with the government since 1917 except for a five-month period in 1930 when he was associated with the Goodyear Tire & Rubber Co. at Akron as manager of foreign and crude rubber research. From 1926 to 1942 he was in charge of rubber activities of the Bureau of Foreign and Domestic Commerce, first as Chief of the Rubber Division, then as Chief of the Leather and Rubber Division, and later (1939-40) as Chief of the Consumption Materials Unit with added jurisdiction over textiles, paints, paper products, etc.

Mr. Holt has authored numerous monographs on the market for rubber and rubber products in various countries. He initiated the Rubber News Letter Service (1922-39), the Rubber Industry Reports (1940-42), the annual surveys of U. S. rubber consumption and year-end stocks, and the quarterly surveys of distributors' stocks of tires. In 1934 he was loaned by Commerce to the N.R.A. where he served as Assistant Deputy Administrator of the Tire Code and Government representative on the Reclaimed Rubber Industry Code.

Confidential Industry Reports

The confidential industry reports prepared by Mr. Holt (1941-42) were influential in the establishment by Rubber Coordinator Arthur Newhall of a statistical committee to reconcile monthly the rubber statistics for the United States and in the initiation of the Scrap Rubber Collection Campaign in June, 1942, which resulted in the collection of over a million tons. He was promoted "for merit" in 1942 because of his influence on the latter campaign.

In January, 1943, Mr. Holt was transferred to the Rubber Development Corp. as Chief of Commercial Research. In 1944 he aided the State Department in statistical work preparatory to the initial meeting of the Rubber Study Group at Washington in January, 1945, attending that meeting and the November, 1945, meeting in London. In 1945 he visited Brazil for the R.D.C., speaking before various groups to urge the need for rubber collection. In 1945-46 he was a member of the working group of the Interagency Policy Committee on Rubber, which was headed by William Batt.

In December, 1945, Mr. Holt was transferred back to Commerce as Rubber Advisor, assigned to the Office of Domestic Commerce. In early 1946 he was designated to conduct a three-month field study of the rubber production prospects of the Far Eastern countries for 1946 and 1947, and his reports proved highly accurate and useful in formulating U. S. Government buying policies for rubber in late 1946. When the Office of Domestic Commerce absorbed the rubber control activities in 1948, Mr. Holt joined the Rubber Division as Assistant Chief, in charge of economic research and information activities.

Everett G. Holt

Recipient of the Commerce Department's Silver Medal for Meritorious Service.

The postwar Rubber Industry Reports prepared by Mr. Holt, which have been issued since March, 1947, are widely circulated among rubber manufacturers, rubber treaders, government offices, etc. He has been a member of the Advisory Rubber Panel of the State Department since 1946 and has served as an advisor to the American Delegate at each meeting. He also contributed background information used in the recent report submitted to Congress by President Truman with respect to synthetic rubber legislation.

Mr. Holt married Evora Frances Hodgdon of Portland, Maine, in 1917. They have three daughters, Bette, Ellyn and Nancy. The entire family attended the award ceremonies on February 14.

Holds Second Post-War Dinner

The second post-war dinner of the Rubber Trade Association of New York, Inc., was held at the Biltmore Hotel in New York City on February 15. Over 250 members and guests, the largest attendance yet recorded, attended the dinner which was preceded by a lengthy reception. Informality was the keynote of the evening although brief addresses were given by R. D. Young, president of the association, J. Louis, chairman of the board, and W. J. Sears, vice-president of the Rubber Manufacturers Association. Mr. Young paid special tribute to the various members of the Bureau of Federal Supply concerned with the purchase of stockpile rubber, several of whom were guests at the dinner. After dinner, a short program of entertainment was offered. The committee in charge of the dinner and reception included S. J. Pike, Jr., S. G. French, and F. Pusinelli.

Discusses Rubber Classifications

Efforts being made in the Far East for the quality classification of all natural rubber to give manufacturers a more nearly uniform raw material were discussed by Dr. E. M. McColm, technical director, Plantation Division, U. S. Rubber Co., on February 22. The occasion was an address made by Dr. McColm before the St. Joseph's Valley Section of the American Chemical Society. Dr. McColm, who recently returned from a trip to the East Indies, said he had been present at meetings in Malaya and Sumatra at which such plans were discussed. He reported that any system of classification adopted in the East Indies will probably depend on United States preference and added that producers are hoping to get valuable advice along these lines from the Crude Rubber Subcommittee recently established by the American Society for Testing Materials, of which Dr. Norman Bekkedahl, of the National Bureau of Standards, is chairman. Referring to the classification system now being used by the French in Indo-China, which divides natural rubber into three plasticity grades and three curing grades, Dr. McColm indicated that there may be considerable argument with the rate-of-cure criterion. An alternative method, he said, involves the division of natural rubber at the plantation into ten to twenty-ton lots and reporting with each lot the average rate of cure and the "standard deviation" from this average.

Goodrich TW Analysis Plan

A new tire and wheel analysis service that may save operators of materials-handling vehicles up to 50% of their industrial tire and wheel costs has been developed by the B. F. Goodrich Co. Under the "TW Analysis" plan, experienced Goodrich engineers throughout the country will visit industrial plants to make complete surveys of materials-handling operations. The survey will cover the types of vehicles used, operating conditions, loads, wheel sizes and other data essential to determine the proper type and size tires and wheels for these vehicles, taking into consideration the particular requirements of each plant. The tire and wheel analysis plan also is available without cost or obligation to manufacturers of materials-handling vehicles.

U. S. Starts DuPont Suit

The United States Government recently began its formal case charging E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., with violating Federal anti-trust laws by monopolizing production of cellophane. The Government introduced 2,591 exhibits contained in 32 volumes totaling 6,000 pages. Under terms of an order handed down in a United States District Court last year, the case is continued until May 15 when DuPont attorneys are to file exhibits and any written objections to the Government documents. On October 10 the Government will file its objections to the DuPont exhibits plus any additional exhibits of its own. After that, probably in November, actual oral argument will begin.

NEW POLYMERS AUTHORIZED BY OFFICE OF RUBBER RESERVE, RECONSTRUCTION FINANCE CORPORATION

Listed below are types and properties of new experimental GR-S polymers (including GR-S latices) which have been authorized by the Office of Rubber Reserve, Reconstruction Finance Corporation, since publication of those in our previous issue. Procedures for the distribution and sale of these polymers will be found in our October, 1945, issue. Normally, experimental polymers will be produced only at the request of the consumers and 20 bales (one bale weighs approximately 75 pounds) of the original run will be set aside if possible for distribution to other interested companies for their evaluation. The 20 bales when available will be distributed in quantities of one or two bales upon request to the Sales Division of Rubber Reserve or will be held for six months after the experimental polymer was produced unless otherwise consigned before that time. Subsequent production runs will be made if sufficient requests are received to warrant them.

X Number	*Manufacturing Plant*	*Date of Authorization*	*Polymer Description*
X-556 GR-S	General, Baytown	11-7-49	A mixture of 50 parts Philblack O and 100 parts of GR-S polymerized at reduced reaction temperature emulsified with Dresinate 214 and potassium ORR soap. Shortstopped with dinitrochlorobenzene; shortstop viscosity of latex 37 ± 5 Mooney. Stabilized with 1.5% PBNA. Sodium lignin sulfonate-Dresinate 731 emulsifying agents in carbon black slurry make-up.
X-557 GR-S	General, Baytown	11-7-49	Same as X-556 GR-S except that the butadiene/styrene ratio is 85/15.
X-558 GR-S	Copolymer, Baton Rouge	11-4-49	GR-S (X-478 GR-S type) polymerized at reduced reaction temperature to be used as standard reference lot starting January 1, 1950.
X-559 GR-S	Goodrich, Port Neches	12-28-49	GR-S polymerized at reduced reaction temperature with cumene hydroperoxide activated recipe emulsified with Dresinate 731 and ORR soap. Shortstopped with dinitrochlorobenzene. Mooney viscosity 52 ± 7. Stabilized with 1.25% Stalite.
X-560 GR-S	Goodrich, Port Neches	12-28-49	Same as X-559 GR-S except monomer charge ratio is 80 parts butadiene and 20 parts styrene.
X-561 GR-S	General, Baytown	12-28-49	A mixture of 50 parts Philblack A and 100 parts GR-S-26. Stabilized with 1.5% Wingstay S. Marasperse used in carbon black slurry make-up.
X-562 GR-S	General, Baytown	12-28-49	A mixture of 60 parts Pelletex and 100 parts GR-S-26. Stabilized with 1.5% Wingstay S, Marasperse and Dresinate 731 used in carbon black slurry make-up.

NOTE: The above new polymers are experimental only and the Office of Rubber Reserve, Reconstruction Finance Corporation, does not make any representations or warranties of any kind, expressed or implied, as to the specifications or properties of such experimental polymers, or the results to be obtained from their use.

Shoe Repairmen Seek Damages

Eighty-five small shoe repairers are seeking $2,700,000 in damages on grounds that major rubber and shoe leather companies have been giving rebates to big retailers. The suit was filed on February 20 in Federal Court, Chicago, Ill., under the Robinson-Patman Act which prohibits secret rebates and provides for treble damages in such cases. Defendants listed in the suit include U. S. Rubber, Catspaw Rubber, Holtite Manufacturing, etc. The suit said companies which received the rebates included Montgomery Ward, Sears-Roebuck and others. The suit charged that the rebates have been paid for the last five years.

Engineers Discuss Synthetics

Progress in synthetic rubber research and development was covered at a regional meeting of the American Institute of Chemical Engineers held at Houston, Texas, on February 28. Dr. Robert V. West, reporting on investigations at the University of Texas, discussed new research results on improved methods for isolating butadiene. Dr. O. E. Dwyer, of the University of Rochester, and Dr. W. A. Gleich, of the Shell Chemical Co., reported on production of superior grades of cold rubber by carrying out reactions at low temperatures with methanol or wood alcohol used as anti-freeze.

Complete Cords, Ltd., Personnel

Personnel arrangements for the Cords, Ltd., Division of the Essex Wire Corporation, located in Newark, N. J., have been completed. A. W. Johnson, vice-president of the Magnetic Winding Co., Division of Essex Wire, is general manager. Jack Baron, who has been associated in the past with Hatfield Wire and Collyer Insulated Wire, is plant superintendent. Frank Villa, formerly associated with Royal Electric, is chief chemist. E. V. Wind is purchasing agent, Al Migliara is personnel manager, and Fred Rothacker will be in charge of the cord set department. Messrs. Baron, Villa and Rothacker were associated with the Cords organization before it was recently acquired by Essex Wire.

Predicts Higher Tire Prices

Prices of passenger tires can be expected to increase between 10 and 12%, probably before mid-summer, according to a statement made in Dallas, Texas, on February 28 by J. P. Seiberling, president of the Seiberling Rubber Co. Necessity for the new increase, Mr. Seiberling said, is attributed to increasing prices on natural rubber and fabrics, as well as higher wage costs due to the pension plans now being negotiated. He set these higher wage costs between 10 and 16%. Should the new increases go into effect, tire prices would be only "slightly above" prewar list prices.

Chemical Data Compilation

The American Cyanamid Co. has announced publication of "Collective Volume I," a compilation of data on several new chemicals which have become available from the company's research laboratories during the last year, and on which separate bulletins have been issued. Some of the chemicals covered are: aryl biguanides, guanylurea salts, beta chloropropionitrile, dialkyl cyanamides, glycolonitrile, lactonitrile, succinonitrile, potassium cyanate. Copies of this bulletin are available upon written request to the New Products Development Department, American Cyanamid Company, 30 Rockefeller Plaza, New York 20, New York.

Herecrol Commercially Available

Herecrol, a synthetic rubber of the acrylonitrile type manufactured under a patented process, is now available from the Heresite & Chemical Co. of Manitowoc, Wisc., in various commercial forms. Herecrol is available as a latex, as an uncured compound, in sheet form, and as a specially prepared liquid for coating purposes. The product is said to have excellent solvent, oil and chemical resistance and a wide temperature range of service. It also exhibits high resistance to oxidation and aging. High tensile strength and elongation are other desirable properties attributed to the product.

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FINANCIAL NEWS

NET EARNINGS OF $15,100,072 SET BY U. S. RUBBER IN 1949

Net earnings of the United States Rubber Company in 1949 were $15,100,072 after taxes and all charges, equivalent to 2.9 per cent of sales and $5.62 a share on the common stock, compared with $20,141,585 or 3.5 per cent of sales and $8.48 a share in 1948, according to the 58th annual report to stockholders released recently by Herbert E. Smith, chairman, and Harry E. Humphreys, Jr., president. Consolidated net sales were $517,439,676, a decrease of 9.5 per cent from the 1948 total of $572,024,663.

The devaluation of foreign currencies, which was reflected in lower value of foreign assets, resulted in a net loss of $1,980,721, after reserves. This loss was more than offset, however, by the credit to income of $2,438,814 for income tax accruals provided in previous years, and now found to be unneeded. The effect of these adjustments was a net credit to 1949 earnings of $458,093, mostly in the fourth quarter.

A substantial volume of production, not reflected in sales to customers, but consumed within the company, was accounted for by the company's rubber plantations, textile mills, chemical and reclaim plants. The value of this production was $74,286,160 in 1949 compared with $93,160,726 in the previous year. In addition, the company operated government-owned synthetic rubber plants at Naugatuck, Conn., and Borger, Texas. The value of production from these two plants in 1949 was approximately $23,400,000 compared with $29,000,000 in 1948.

Natural Rubber Production

Production of natural rubber on the company's plantations in Malaya and Sumatra totaled 49,000,000 pounds, a "reasonably satisfactory level." A large percentage of this production was shipped to the United States in the form of natural concentrated latex for use in the manufacture of foam rubber and other products. Operations in Malaya and Sumatra are still hampered by political and economic unrest. The company is financing operations and rehabilitation with funds produced within the two countries by the sale of rubber, and at the present time is not investing American dollars in the plantations.

Federal and foreign income taxes in 1949 totaled $7,995,669 compared with $14,757,417 in the previous year. As previously stated, the year 1949 was favorably affected by the credit of $2,438,814 accrued in past years and now found to be unneeded. In addition, the company paid $2,879,954 in social security taxes, compared with $3,171,007 in 1948, and state, county and local taxes of $7,835,418 in 1949 against $8,514,435 in the previous year. The company also collected federal excise taxes from customers in the amount of $33,267,680 compared with $34,729,822 in 1948.

The report said great progress had been made during the year in improving the company's financial position. Cash and U. S. Treasury savings notes totaling $57,498,896 at December 31, 1949, were $9,583,066 higher than at the previous year end, the report said. During the year the company paid $3,000,000 on serial bank notes and purchased $2,188,000 face value of its 2⅝ per cent debentures due April 1, 1967, in advance of sinking fund requirements. Since December 31, 1948, inventories and receivables decreased $24,704,392 and $5,984,013, respectively.

The balance sheet for 1949 showed current assets of $226,922,115 against current liabilities of $58,983,606, giving a net working capital of $167,938,509 compared with $172,061,578 in 1948. The net quick ratio for 1949 was 3.86 to 1 compared with 3.26 to 1 in 1948.

A total of $179,272,941 in wages and salaries was paid in 1949 to an average of 56,521 employees, excluding those on the rubber plantations, against $202,544,143 paid during 1948 to an average of 64,208 employees. In addition, the company paid retirement allowances of $1,234,102 to 2,227 former employees compared with $1,071,301 paid in the previous year to 2,078.

Additions to property and plant, including the acquisition of a vinyl plastic plant at Painesville, Ohio, amounted to $16,184,600. Deductions amounted to $17,194,373, which included depreciation of $13,327,649, disposals of $486,514 and adjustments of $3,380,210 resulting from foreign currency devaluations. The net decrease in property and plant was $1,009,773. Depreciation in 1948 was $13,749,739.

General Tire & Rubber Co.

Year Ended November 30: Net profit of $1,014,883, which is equivalent to 94 cents a common share, against $4,783,617, or $7.33 a share, for the preceding year. Net sales of $92,579,553 were reported for 1949, compared with net sales of $105,908,203 in 1948. Balance sheet items as of November 30, 1949, revealed current assets of $45,931,581 and current liabilities of $10,901,098, contrasted with $50,030,828 and $14,536,461, respectively, for the year ended November 30, 1948.

Flintkote Company

For 1949: Net income of $5,825,579 after taxes and all charges, which is equal to $4.33 each on the 1,260,435 shares of common stock outstanding, compared with $7,748,683, or $5.86 each on 1,257,935 shares outstanding in 1948. Net sales declined to $67,815,156 from the 1948 volume of $81,297,857.

Eagle-Picher Company

Year Ended November 30: Net credit to surplus of $2,747,147, which is equal to $3.09 per share, compared with $4,067,741, or $4.57 per share, in 1948. The net credit to surplus in 1949 was after a transfer of $4,704,441 from the reserve for future decline in inventory values, while in 1948 it was after an appropriation of $1,500,000 to that reserve. Net sales for the year ended November 30, 1949, amounted to $63,349,821, against $79,478,724 for the preceding fiscal year, a decline of 20.3%. At November 30, 1949, the net worth of the company amounted to $24,113,250, equivalent to $27.12 per share, compared with $22,966,441, or $25.83 per share at November 30, 1948. Net current assets decreased from $14,195,110 at the end of the 1948 fiscal year to $12,753,933 at November 30, 1949.

Armstrong Cork Co.

Year Ended December 31: Net profit of $10,224,215, which is equal to $6.57 a common share, compared with $11,567,524, or $7.54 a common share in 1948. Net profit for 1948 included a non-recurring item of $1,462,500 after taxes resulting from reduction in quantities of certain raw materials carried in inventory, and realization of a claim under wartime contract. Net sales for 1949 totaled $163,323,948, against $173,088,849 the year before. As of December 31, 1949, current assets totaled $49,766,671, against $47,646,510 a year earlier; current liabilities declined to $12,936,645 from $14,935,011 in 1948.

New Jersey Zinc Co.

For 1949: Net profit of $4,390,956, exclusive of extraordinary net expense of $1,460,157 which was deducted from reserve for contingencies and after provision of a $500,000 contingency reserve, which is equal to $2.24 and which compares with $9,435,814, equal to $4.81 a share, after providing a contingency reserve of $1,000,000, reported for the previous year. Net profit for the December quarter amounted to $669,684, equal to 34c a share, as compared with $3,074,271, or $1.56 a share, in the December quarter of 1948.

American Zinc-Lead-Smelting

Year Ended December 31: Net profit of $573,915, which includes a credit adjustment of $110,000 for Federal income taxes of prior years, and which is equal to 35 cents each on 673,100 shares of common stock outstanding, against $935,250, or 91 cents each on an equal number of shares the year previous. Net sales for 1949 amounted to $33,326,802, compared with net sales of $38,850,809 the year before.

Rome Cable Corp.

December Quarter: Net profit of $164,227, which is equal to 41 cents a common share, compared with $356,483, or 89 cents a share, in the corresponding quarter of 1948.

NET INCOME OF $20,230,520 SHOWN BY GOODYEAR IN 1949

Operations of the Goodyear Tire & Rubber Company in 1949 resulted in consolidated net sales of $633,505,978 and consolidated net income of $20,230,520, equivalent to $8.40 per share of common stock outstanding, P. W. Litchfield, Chairman of the Board, announced recently. Last year's sales were approximately 10 per cent below those of 1948 which set a peacetime record of $704,875,941. Comparable net income for 1948 was $24,095,518, equivalent to $10.25 per common share. Income per dollar of sales declined from 3.4 cents in 1948 to 3.2 cents last year.

Net income of Goodyear's foreign subsidiaries amounted to $9,898,430 in 1949. Dividends totaling $4,860,269 were received from these subsidiary companies during the year, the remaining earnings being invested in plants and equipment or added to their working capital.

Mr. Litchfield pointed out that Goodyear had made provision in prior years for the devaluation of foreign currencies which took place in 1949 by setting up a reserve for foreign investments. This has been utilized to the extent of $6,667,000 to adjust net equity values outside the United States to the new lower rates of exchange. In addition, the company charged 1949 operations with $3,960,169 because of continuing restrictions on the remittance of earnings in certain countries. At the year-end, equity in fixed and current assets of subsidiaries outside the United States amounted to $51,742,626, in respect of which there remains in the foreign reserve a total of $14,363,169.

Goodyear's working capital reached a new high of $262,045,036 at the end of 1949, with cash and government securities amounting to $98,284,491. The ratio of current assets to current liabilities stood at 7 to 1 compared with 6½ to 1 a year ago. Earned surplus at the year-end amounted to $126,269,476, not including $3,000,000 segregated and added to the reserve for contingencies to provide for the current high cost of plant additions and replacements. The company's report revealed that a $75,000,000 revolving bank credit, arranged in 1946 to be available through October 15, 1951, had been canceled as it was no longer considered necessary.

The steadily increasing demand for tires in nearly all countries where Goodyear has plants makes it advisable for the company to consider increasing many of these operations, Mr. Litchfield reported, and the cost of modernizing domestic plants to keep pace with rapidly increasing technological developments indicates considerable outlays for these purposes. It is also necessary to provide for the manufacture of new items developed by the Research Department and to increase capacity for producing Airfoam, one of Goodyear's fast developing products.

Because these additions and improvements are costing from two to three times the pre-war cost, Mr. Litchfield explained, the company has considered it advisable to retain in the business a substantial proportion of profits and also to transfer $3,000,000 to reserves.

Sprinkler Check-Up Program

The importance of investigating sprinkler systems for possible obstructions was recently brought home forcibly to the management of the Firestone Tire & Rubber Company. Flushing the piping in their Akron, Ohio, plants, employees found sufficient material to seriously impair the protection of some buildings. To take full advantage of this experience, the management has set up a program for checking the sprinkler systems at all of their many properties in the United States and Canada.

DeVilbiss Company

Year Ended December 31: Consolidated net profit of $3,340,124, of which $2,254,500 was derived from operations in the United States and the remainder in Canada (U. S. dollars). The net is equal to $1.73 each on 1,779,888 common shares outstanding, compared with a consolidated net profit of $5,103,058, or $2.67 a common share, in 1948. The 1948 net consists of $3,908,187 which was earned in the United States and the remainder in Canada. Net sales in the United States during 1949 were $42,888,118, compared with $45,801,106 in 1948. Canadian net sales in 1949 were $16,112,788, against $15,103,211 in 1948 (Canadian dollars). The report covers the company and its wholly-owned domestic and Canadian subsidiaries, but does not include $689,638 income derived from the Southern Paperboard Corp. in 1949.

Dewey & Almy Chemical Co.

For 1949: Net earnings of $976,493, an increase of 39% over 1948 and 29% over the previous all-time high in 1941. Net sales were $16,297,002, up 3% from 1948 and marked the seventh consecutive year in which sales have exceeded any previous year. Dividends paid in 1949 totaled $319,949 or $1.00 per share, compared to $1.40 in 1948.

National Automotive Fibres, Inc.

For 1949: Net profit of $4,416,675, which is equal to $4.43 each on the 996,145 shares of capital stock outstanding, compared with $3,140,435, or $3.25 each on 953,779 shares for 1948. Consolidated sales for the past year totaled $64,540,553, against sales of $50,025,864 in 1948.

Plymouth Rubber Co.

Year to November 30: Net income of $246,892, which is equal to 27 cents a share, against $159,167, or 17 cents a share, for the previous fiscal year. Net sales for the 1949 fiscal year amounted to $11,236,934 compared with $10,631,190 in the previous year.

$20,935,738 GOODRICH INCOME SHOWS DROP FROM 1948 TOTALS

After provision for all charges, including taxes and depreciation, and after providing reserves of $4,000,000 for increased replacement cost of facilities, and $1,000,000 for foreign losses and other contingencies, net income of the B. F. Goodrich Co. for the year ended December 31, 1949, amounted to $20,935,738, or $14.36 per share of common stock outstanding after deducting the regular $5.00 dividend on preferred shares. The corresponding net income for 1948 was $23,740,705, which amounted to $16.57 per common share, after reserves of $8,000,000.

Net sales for the period declined 7.6% to a total of $387,918,386 against $419,798,703 in 1948. Taxes amounted to approximately $40,932,000, which is equivalent to approximately $31.15 per share of common stock. Dividends paid during 1949 were $5.00 per share on preferred stock, and $5.50 per share on the common stock. The latter amount included an additional dividend of $1.50 at the year-end.

As of December 31, last, current assets amounted to $188,270,971 and current liabilities to $28,205,699, compared with $181,201,917 and $32,811,965, respectively, a year earlier. Inventories were reduced to $84,547,661 from $99,908,916 at the close of 1948. Capital expenditures last year amounted to $12,137,000.

Net assets employed outside the United States at the year-end were 7.1 per cent of the total consolidated net assets and amounted to $14,686,000, of which $5,873,000 was in Canada. Of this amount, $11,254,000 applied to net current assets and $3,432,000 to net other assets.

United Carbon Co.

Year Ended December 31: Net income of $2,866,534, which is equal to $3.60 per share of common stock, contrasted with $3,113,367, or $3.91 a share, the year before. Net sales for 1949 totaled $21,555,495, against $26,034,886 in 1948. Balance sheet items at the end of 1949 indicated current assets of $10,834,763 and current liabilities of $3,058,101, compared with $10,470,777 and $3,758,344, respectively, at the end of the preceding year. Capital expenditures in 1949 totaled $4,410,509 and in addition gross property account was increased by $3,335,893 by the acquisition of the capital stock of the Charles Eneu Johnson Co., Inc. Carbon black sales during 1949 dropped 17.4% to 210,234,000 pounds. Dollar sales of black dropped 20.7% to $13,783,000.

Brown Rubber Company

Year Ended December 31: Net profit after taxes of $1,239,420, which is equal to $4.94 each on 251,100 capital shares, compared with $891,492, or $3.55 each on an equal number of shares for 1948. The report stated that $408,574 was invested in new facilities in 1949, and $715,000 has been budgeted for additional buildings, machinery and equipment to be completed by July, 1950.

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LOS ANGELES NEWS

Approximately 250 members and guests attended the February 7 meeting of the Los Angeles Rubber Group held at the Mayfair Hotel in Los Angeles, Calif. The meeting was sponsored by the Firestone Tire & Rubber Co., honoring the 40th anniversary of the Boy Scouts of America. Leonard K. Firestone, president of the Firestone Tire & Rubber Co. of California, acted as host. In a brief address, Mr. Firestone impressed upon the members the need for company-sponsored groups to assist the Scout movement and to make it possible for more boys to participate in scouting. Arnold C. Sorenson, Chief Scout Executive of the Los Angeles Council Area, addressed the group on the subject "But He's My Son."

Boy Scout patrols from troops sponsored by Firestone and Goodyear were present as guests of the group. Considerable interest was shown in the colored moving picture "Liberia," which depicts the production of natural rubber on the Firestone plantation in Liberia.

A technical group meeting preceded the regular meeting. A. R. Kemp, formerly in charge of organic, rubber and plastic research for the Bell Telephone Laboratories, spoke on the subject "Compounding Rubber for Electrical Properties." An abstract of Mr. Kemp's address is presented elsewhere in this issue.

The 1950 copies of the Los Angeles Rubber Group Year Book are now ready for distribution. Copies may be obtained free-of-charge by writing the Los Angeles Rubber Group, Inc., c/o R. L. Short, 811 West 58th Street, Los Angeles 37, Calif.

The election of M. M. Barton and T. A. Kelly as vice-presidents of the W. J. Voit Rubber Corporation was recently announced. Mr. Barton, who has been associated with the company since 1935 in various capacities, most recently as western representative, will be in charge of advertising and western sales, with headquarters in Los Angeles. Mr. Kelly, with the company since 1941, will be in charge of sales east of the Rockies and will make his headquarters at Chicago.

Golden State Rubber and Latex Corp., a new rubber product manufacturing company, has started business in the plant formerly operated by the Golden State Rubber Mills and the Latex Seamless Products Co. at 657 East 61st St. Douglas Chalmers, formerly chief chemist of the Gates Rubber Co., Denver, Colo., is president of the new company. The new firm is specializing in production and product development in latex dipped, sprayed and coated products of natural and synthetic rubbers, as well as custom molding and stock preparation.

Ray Morath, branch manager of the Naugatuck Chemical Division of the U. S. Rubber Co., at 19201 S. Vermont Ave., entered Hollywood Leland Hospital on February 15 for surgery to clear up an ulcer condition. It was expected that he would be in the hospital for about two weeks.

North American Rubber, Inc., 5001 Firestone Boulevard, South Gate, has announced that they have moved into their No. 2 plant on Firestone Boulevard where they will manufacture foam and sponge rubber products.

Typrene Roller Co., 1504 East 4th St., has been sold to the Ideal Roller & Manufacturing Co., Chicago 8, Ill. The Los Angeles plant will be operated as the Western Branch of the Chicago concern. Ideal will add the manufacture of vulcanized oil rolls to the Los Angeles plant so that all materials for western distribution can be manufactured here. Fred Thistle, former partner in Typrene Roller, will be sales agent for Ideal's new Western Branch. T. J. Willey, also a partner in Typrene Roller, will continue as manager of the Los Angeles plant.

Harry Franklin has purchased an interest in the Stillman Rubber Co., 12224 Budlong Avenue.

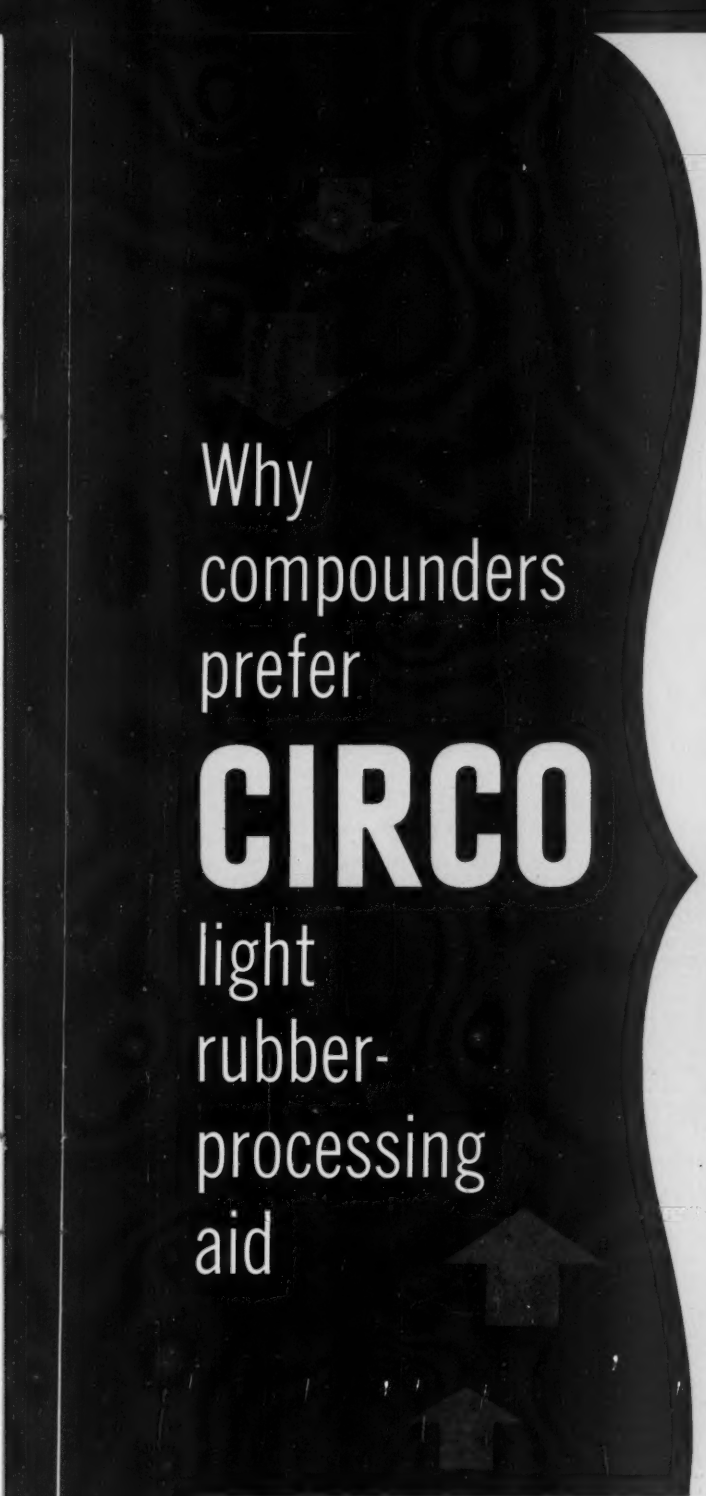
Plans New Office Building

Plans for the construction of a $3,000,000 office building have been announced by the Minnesota Mining & Manufacturing Co., St. Paul, Minn. The new office building will relieve congestion in the present main office building, permit the consolidation of scattered office groups and allow for future expansion. Company officials hope to begin construction within the next few months so that the building can be ready for partial occupancy by January 1, 1951, and completed by the summer of 1951. The building is designed for seven floors and a full basement, although only five floors will be built for the present. The other two stories will be added as needed. Another part of the firm's expansion program is a two-story, block-long manufacturing plant now under construction in St. Paul. It is scheduled for completion this fall and will cost more than $2,000,000.

January Consumption Rises 12%

Estimated consumption of new rubber during January rose quite sharply to 94,383 long tons from 84,124 tons in December, an increase of 12.20%, according to the Rubber Manufacturers Association. Use of natural rubber during January was at the highest level since 1941, reaching 60,241 long tons, an increase of 14.35% over December, 1949, when consumption of natural rubber amounted to 52,681 tons. Consumption of synthetic rubbers in January increased 8.58% to 34,142 long tons against the 31,443 tons consumed the month before. Reclaimed rubber use during January was estimated at 20,472 long tons, 12.19% higher than the December tonnage of 18,247 tons.

The 1950 officers and directors of the Los Angeles Rubber Group are depicted above. The officers are seated, left to right, as follows: L. E. Budnick (Ohio Rubber), treasurer; R. D. Abbott (Abbott Co.), associate chairman; E. C. McLaughlin (Royal), chairman; R. L. Short (Kirkhill Rubber), vice-chairman; C. S. Hoaglund (Goodyear), secretary. The directors, standing left to right, are: W. J. Haney (Kirkhill Rubber), A. J. Hawkins, Jr. (DuPont), C. H. Churchill (Sterling Rubber), and D. C. Maddy (Harwick Standard Chemical). Mr. Hawkins has since been transferred to Chicago, and has been replaced as a director by F. C. Johnston of the Caram Manufacturing Co.



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Circo has been used by rubber processors for over 12 years. Hundreds of rubber manufacturers are sold on the performance and durability of goods processed with Circo. They know that such products turn in remarkable service records.

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CANADIAN NEWS

A group of members, partners and senior office personnel of member firms of the Toronto Stock Exchange recently visited the plant of the Goodyear Tire & Rubber Co. of Canada at New Toronto. The visit was in line with the Exchange's new policy of familiarizing those working with it with the operations of various listed industrial and mining companies. The plant visit was followed by a brief talk by R. C. Berkinshaw, vice-president and general manager, who touched on the capital structure of the company, its growth and development, and future prospects.

Increased employment will result from an expansion program planned by the company, James I. Simpson, president of the Dunlop Tire & Rubber Goods Co., Ltd., told members of the company's 25-year club at their annual banquet recently held in Toronto. Eleven employees became members of the club during the past year, all of whom received gold watches in recognition of their service. Membership of the club now exceeds 200 in the Toronto area.

David B. Collett, formerly general works manager of the Dunlop Rubber plant at Speke, Liverpool, England, was recently appointed vice-president and general manager of the Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

Employees of G. H. Wood & Company, Ltd., manufacturers of sanitation equipment, with headquarters in Montreal and branches throughout Canada, have introduced a new note in employer-employee relations. By employee subscription, they have raised enough money to run a special two-color advertisement in 11 national publications in the business, financial and industrial sanitation fields. The advertisement is a public tribute to G. H. Wood, president and general manager of the company, who is described "not only as a business leader, but also as a grand fellow and a good friend who is interested in our welfare."

Vinylite plastic, produced by Canadian Resins & Chemicals, Ltd., Montreal, have been awarded the Seal of Approval from the Chatelaine Institute, maintained by *Chatelaine Magazine*. It is the first plastic material to receive the award from the Institute. Qualification for the Seal demands that the product undergo thorough testing at both the Institute and outside laboratories to make certain that it maintains the standard of quality claimed by the manufacturer.

Completion of a $1,500,000 addition to its plant at Hamilton and a $750,000 warehouse branch in Toronto was recently announced by the Firestone Tire & Rubber Co. of Canada, Ltd. Plans are also underway for a $750,000 warehouse branch in Montreal. Additional office and warehouse space also will be built by the company in three western Canadian cities because of the growth of business and industry in that area.

Sir George Godfrey & Partners of Canada, Ltd., Montreal, has announced the development of a new lightweight acid bucket. Made of translucent polyethylene, the new bucket is not affected by most common acids of whatever concentration or by caustic alkalis. It is reported to be practically impervious to all solvents at normal temperatures. The bucket comes in two sizes, 1¼ and 2¼ Imperial gallons, and is available with a full-closing separate lid.

Dunlop Tire & Rubber Goods Co., Ltd., of Toronto, Ont., has reported a net loss of $176,000 for 1949, compared with a net profit of $245,000 the preceding year. Sales volume dropped 15% from 1948 levels, mainly as a result of the sharp decline which occurred when goods were not available to meet customer demands. Balance sheet items as of December 31, 1949, indicated current assets of $4,667,435 and current liabilities of $1,540,053, against $5,788,355 and $2,377,350, respectively, at the end of 1948.

Goodrich Secures Uranium Metal

The Atomic Energy Commission recently made available a small quantity of uranium metal for experimental uses. The B. F. Goodrich Research Center at Brecksville, Ohio, has obtained a license to purchase a quarter pound of this metal. According to E. H. Rowe, who has charge of the electron microscope work at the laboratory, the metal will be used to enhance the usefulness of the electron microscope, employed to "shadow cast" microscope samples showing low contrast. Heretofore, chromium has been used at the laboratory for shadow casting, but use of the uranium is expected to permit the study of considerably smaller objects.

New General Tire Treasurer

Tracy S. Clark, assistant treasurer since 1936, has been named treasurer of the General Tire & Rubber Co., succeeding John O'Neil, who has resigned. Mr. O'Neil expects to enroll at St. Charles Seminary, Baltimore, Md., to study for the priesthood. Mr. Clark, the new treasurer, joined the General Tire organization in 1925 after serving in credit work with two other rubber companies. He has been a member of the company's credit department since that time, retaining management of that department when he was appointed an assistant treasurer in 1936.

Heads Firestone Order Department

L. A. Greene

L. A. Greene, formerly operating assistant to L. R. Jackson, president, has been named head of the order department of the Firestone Tire & Rubber Co., succeeding T. L. Smith, retired. Mr. Greene attended Ferris Institute in Michigan and was graduated from the University of Akron. He also has a degree of bachelor of laws from Detroit College of Law and is a member of the Michigan Bar. Mr. Greene has 15 years of service with Firestone. He started in the Detroit district as an accountant and served as office manager in the Grand Rapids, Mich., and Toledo, Ohio, districts before coming to Akron in 1939 as a member of the sales operating department. In 1941 he became operating assistant for Mr. Jackson, then vice-president in charge of sales. New administrative assistant to Mr. Jackson is F. F. Censky, formerly assistant manager of the marketing research department.

Preview New Carbon Black Film

The premier showing of "A Study in Black," a new sound film in full color produced by Caravel Films of New York for the Godfrey L. Cabot Co., Inc., of Boston, was held at the Waldorf-Astoria in New York on February 15. The new film, an improvement over an earlier one made for the company in 1939, describes the research, development manufacture and applications of both channel and furnace carbon blacks and their raw materials. Uses of the blacks are dramatically portrayed. The preview was held for an audience of some 100 prominent industrialists, press and trade journal representatives. Thomas D. Cabot, vice-president and treasurer of Godfrey L. Cabot, Inc., made a brief address before the showing, during which he emphasized the important role played by carbon black in every day living. Another film, "Good Company," prepared from a labor relations angle, was also shown. The carbon black film, "A Study in Black," will be made available to technical groups in the rubber, ink, paint and other industries.

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Pip-Pip (Piperidine N-Pentamethylene-dithiocarbamate) • R-2 Crystals • Santocure* (N-Cyclohexyl-2-benzothiazyl-sulfenamide) • Thiocarbanilide (A-1) • Thiofide* (2-Benzothiazyl Disulfide) • Thiotax (2-Mercaptobenzothiazole) • Thiurad* (Tetramethyl-thiuram-disulfide) • Ureka* Base (2, 4-Dinitrophenyl-2-thiobenzothiazole) • Ureka C (2-Benzothiazyl Thiolbenzoate)

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SERVING INDUSTRY . . . WHICH SERVES MANKIND

OBITUARIES

Joseph B. Hanan

Joseph B. Hanan, retired staff superintendent of the Industrial Products Division of the B. F. Goodrich Co., Akron, Ohio, died on February 26 in Winter Haven, Fla. He was 61 years old. Born in Medina County, Ohio, Mr. Hanan was graduated from the Sharon Center School in 1905. He then worked his way through Buchtel College, now the University of Akron, graduating in 1910. He began teaching in Wadsworth High School and two years later was named superintendent of schools in Auburn, Ohio. Mr. Hanan also took post graduate work and instructed at Kent State College. He joined the Tire Sales Division of the B. F. Goodrich Co. in 1918 and retired from active duty with the company 29 years later. Mr. Hanan was active in Akron Ku Klux Klan circles, and served as president of the Akron board of Education when the Klan majority ruled the board. He resigned as exalted cyclops of the Akron chapter in 1926 after serving for two years. Funeral services were held in Kent, Ohio. He leaves his wife and daughter.

Leland H. Plant

Leland H. Plant, manager of time study and methods engineering at the Memphis, Tenn., plant of the Firestone Tire & Rubber Co., died on February 8 at his home in Memphis after an illness of five weeks. He was 43 years old. A native of Clarksburg, W. Va., Mr. Plant came to Akron when he was 6 years old. He attended Firestone Park Grade School and was graduated from South High School. Upon his graduation from the University of Akron in 1928, he joined Firestone. He was transferred to Memphis in 1938. While at South High, Mr. Plant was named All-City center in football. He was All-State football center at the University of Akron. Services were held on February 10 at the Billow Funeral Home in Akron, with burial in Rose Hill Cemetery. He leaves his wife and a son.

Robert H. Lambert

Robert H. Lambert, a chemist and compounder in the Airfoam Division of the Goodyear Tire & Rubber Co., died on February 26 at a hospital in Boston, Mass. He was 32 years old. Mr. Lambert had been on sick leave from Goodyear since December 27. A graduate of Tufts College, Mr. Lambert had worked with the Hood Rubber Co. in Cambridge, Mass., and the American Hard Rubber Co. in Akron before joining Goodyear on February 1, 1948. He was a member of the board of trustees of the Junior Chamber of Commerce in Akron. Funeral services and interment took place in Winthrop, Mass., on March 1. His mother survives.

Thomas A. Unsworth

Thomas A. Unsworth, president, treasurer and general manager of the E. B. and A. C. Whiting Co., and president and treasurer of the Queen City Tulatex Corp., both of Burlington, Vt., died on February 14 in Burlington. He was 73 years old. Born in Cleveland, Ohio, Mr. Unsworth attended schools in Liverpool, England, and returned to the United States at the age of 10 to finish his schooling in New York. In 1909, Mr. Unsworth established the Brush Fiber Supply Co. in New York. He came to Burlington in 1913, merged his company with the Whiting Co. and began expanding the concern which is believed to handle 90 percent of the brush fiber business in the United States today. Mr. Unsworth also developed a rubberized curled fiber called Tulatex, manufactured by the Queen City concern. He leaves his wife and five children.

Clement E. Eckrode

Clement E. Eckrode, retired rubber engineer, died on February 26 at his home in Akron. He was 73 years old. Born in Stark County, Ohio, Mr. Eckrode came to Akron as a young man and was associated with the old India Rubber Co. and the B. F. Goodrich Co. at the turn of the century. He later was with the Lee Rubber & Tire Co. in Conshohocken, Penna. Mr. Eckrode established the Endurance Tire & Rubber Co. at New Brunswick, N. J., and also the Eckrode Rubber Co. in New Brunswick. During World War II, he served as a consultant of rubber compounds with the General Machine Ordnance Corp. in West Charleston, W. Va. Private funeral services were held on February 27 at the Eckard Funeral Home in Akron. The body was taken to New Brunswick for interment. His daughter survives.

Lister A. Deaver

Lister A. Deaver, management agent in rubber chemicals in Akron, Ohio, died of a heart attack at Iacomini's Restaurant in Akron on February 3 while attending a meeting of rubber executives. He was 57 years old. Mr. Deaver was born in Bloomington, Ill. He was graduated from Illinois Wesleyan University and the University of Illinois with degrees in chemistry. He started work with the B. F. Goodrich Co. in 1917 as a chemist in the Development Department. In 1927 he went to England with the Philadelphia Rubber Co., a Goodrich subsidiary, where he stayed until 1940. During World War II, Mr. Deaver was employed by the Standard Products Co. in Cleveland, Ohio. Services were held on February 6 at the Hudson Episcopal Church, Hudson, Ohio. His wife, a son and a daughter survive.

George Disney

George Disney, for the past 32 years associated with the Development Department of the Goodyear Tire & Rubber Co. in Akron, Ohio, died on February 26 at his home in Akron. Mr. Disney, who was 62 years old, had been in failing health since November, 1949. Born in Baltimore, Md., Mr. Disney was graduated from the Law School of the University of Maryland and was admitted to the Maryland Bar at the age of 19. He practiced law in Maryland for 10 years before joining Goodyear at Akron. He was past master of Joppa Lodge No. 666, F. & A. M., and belonged to the Akron Chapter, Akron Council, Bethany Commandery and Yusef-Khan Grotto. He also was a member of the Goodyear Twenty-Five Year Club. Funeral services were conducted on March 1 at the Adams Funeral Home in Akron, with burial in Rose Hill Cemetery. He leaves his wife and daughter.

Walter J. Breth, Sr.

Walter James Breth, Sr., inventor of an automatic tire building machine and associated with the Experimental Division of the General Tire & Rubber Co., Akron, Ohio, died at his home in Akron on February 10. He was 61 years old. Born in Mahaffey, Penna., he joined General in 1921 as a repairman. Mr. Breth was eventually recognized as General's top mechanic. The machine he invented was twice as fast as any automatic tire builder previously developed, turning out 720 tires in 24 hours. Services were held on February 13 at the East Market Street Church of God in Akron, with interment in Mt. Hope Cemetery. He leaves his wife, three sons and a daughter.

John S. Britton, Sr.

John S. Britton, Sr., for many years general manager of the Bay Division of Parke-Davis & Co., Bridgeport, Conn., died at his home in Fairfield, Conn., on February 14. He was 59 years old. At his death Mr. Britton was a director of the First National Bank and Trust Co. of Bridgeport, a member of the Bridgeport Chamber of Commerce, and a member of the Manufacturers Surgical Trade Association. He was a past president of the Brooklawn Country Club, past commodore of the Black Rock Yacht Club and a former member of the Bridgeport Rotary Club. His wife, a son and a daughter survive.

Mildred Bedford Vanderbilt

Mrs. Mildred Bedford Vanderbilt, wife of Robert T. Vanderbilt, president of the R. T. Vanderbilt Co., New York, N. Y., died on February 13 in New York Hospital after a short illness. Mrs. Vanderbilt was born in Brooklyn, N. Y. Her father, the late Frederick H. Bedford, was a director of the Standard Oil Co. of New Jersey for many years. Funeral services were held on February 16 at Green Farms, Conn. Surviving, besides her husband, are three sons.

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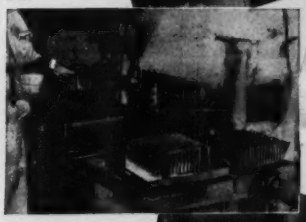

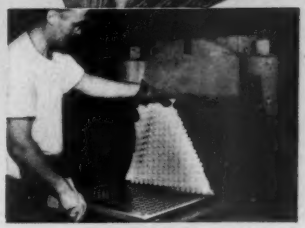

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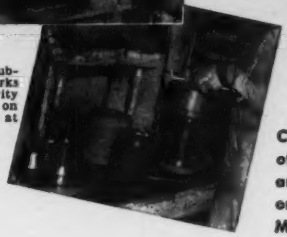

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Edwin S. Boyer

Edwin S. Boyer, retired chairman of the board of the American Hard Rubber Co., New York 13, N. Y., died on February 21, in Muhlenberg Hospital, Plainfield, N. J. He was 74 years old. Born in Philadelphia, Penna., on April 17, 1875, he was graduated from Friends School in Philadelphia, and the University of Pennsylvania. In 1899, he went to New York as manager of the New York Office of the American Engine Co. In 1905, he became associated with the Walter Kidde Co. as a mechanical engineer, later being made a director. Mr. Boyer was engineer in charge of constructing the American Hard Rubber Co. plant in Akron, in 1916. The next year he became assistant works manager of the company. He was elected president of the firm in 1926, and chairman of the board in 1943. He retired in 1946. Mr. Boyer was for many years a director and on the advisory board of a branch of the Chemical Bank and Trust Co. He was also a director of several insurance companies. Mr. Boyer was a 50-year member of the American Society of Mechanical Engineers. Funeral services were held on February 24 in Plainfield. His wife and son survive.

Battery Manufacturers Sued

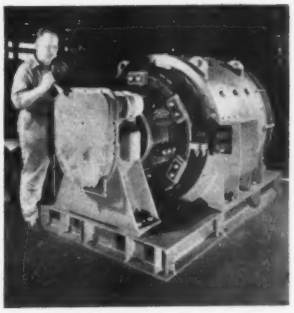
The Department of Justice filed an anti-trust action on February 6 against the Association of American Battery Manufacturers, 22 companies and 22 individuals to stop alleged violations of the Sherman Anti-Trust Act in the sale and distribution of used storage batteries and lead salvaged from the batteries. Among firms charged were the Goodyear Tire & Rubber Co., B. F. Goodrich Co., Firestone Tire & Rubber Co., Sears, Roebuck & Co., and Montgomery Ward & Co. Attorney General Howard J. McGrath said the action was filed simultaneously with an indictment returned aaginst the defendants by a Federal grand jury at Kansas City, Mo. It alleges that sales were made only to the conspiring scrap metal companies which agreed to destroy the batteries and sell the lead extracted from them to the National Lead Co. National Lead, in turn, agreed to sell the refined lead back to the manufacturer of the original batteries, the indictment charged.

American Monomer Corp. Formed

American Monomer Corporation has been formed in Boston to provide industrial and chemical research groups with a central source of supply for specialty monomers. Production has been started on glacial acrylic and methacrylic acids; diallyl oxalate, succinate, fumarate, maleate, and adipate; allyl methacrylate; cyclyhexyl methacrylate; 2-ethoxyethyl methacrylate; ethyleneglycol dimethacrylate; tetrahydrofurfuryl methacrylate; 2-ethoxyethyl acrylate; vinyl methacrylate and benzoate, and N-vinyl phthalimide, and several other monomers are expected to be added to the list in a short time. At the present time, the monomers are being sold only in laboratory quantities, but some are available in pilot plant quantities and production can be expanded to carload lots if required.

Calender Drive Motor

The 600-hp, 300/450-rpm calender drive motor illustrated herewith, believed to be the largest of its kind built to date, has been shipped by Allis-Chalmers Manufacturing Co. to a midwestern manufacturer where it will be used to produce tire ply at the fastest rate in the rubber industry. With its supporting motor-generator set, this motor is part of an integrated electri-



cal drive for the calender and its auxiliary equipment. It is designed with a low Wk^2 so that emergency calender roll stops can be made within the guaranteed value of 14 inches of calender roll travel from the full load speed of 450 rpm. This corresponds to 100 yards per minute of the calender roll. The motor, which will drive the calender at speeds of eight to 100 yards per minute, is equipped with a bearing temperature relay, geared tachometer and speed limiting device. The supporting motor-generator set consists of a 500-kw, 600-volt d-c generator driven by a 703-kva, 80% pf, 2,300-volt, 900-rpm synchronous motor. It, too, is equipped with bearing temperature relays and speed limiting device.

Cabot Makes Sales Changes

Godfrey L. Cabot, Inc., Boston, has announced that effective April 1 the marketing of its products throughout the United Kingdom will be handled by Cabot Carbon, Ltd., Dashwood House, Old Broad St., London, E.C.2, England. These products were formerly handled by Hughes & Hughes, Ltd., of London. The General Atlas Carbon Co., a Cabot subsidiary, will similarly market its Gastex and Pelletex brands through Cabot Carbon, Ltd. These items were formerly handled by R. W. Greeff & Co., Ltd., of London. In addition to handling the sale of the American-produced carbon blacks and other products of the parent concern, Cabot Carbon, Ltd., will also sell the output of its carbon black plant at Ellesmere Port, now under construction. The net result of these changes is that Cabot Carbon, Ltd., will be in a position to offer to the British trade a complete line of both American and British produced carbon blacks. Alfred Nash, formerly managing director of Hughes & Hughes, has been named sales director for Cabot Carbon, Ltd. He will work closely with Louis Cabot, 28-year-old managing director of Cabot Carbon, Ltd.

Aage Bendixsen

Aage Bendixsen, president, director and chairman of Hecht, Levis & Kahn, Inc., rubber merchants of New York, died at his home in New York on February 25 at the age of 62. Mr. Bendixsen was born in Thisted, Denmark, and from there moved to London, where in 1922 he founded the firm of Bendixsen & Co., Ltd., of London and Singapore. He was president of the firm until 1932 and also served as the president of the Rubber Trade Association of London. After coming to New York in 1932, he became a member of Hecht, Levis & Kahn. He was also president and a director of Hecht, Levis & Kahn, Ltd., of Toronto, Canada; chairman of the New England Trading Corp.; president of the Foram Corp.; a director of the Allentown Rubber Corp., and a director of the Allentown Warehouse Corp. He was also a director of Yu Tung Tai, Ltd., Hong Kong, and the United Hong Kong Co., Ltd., of New York. Mr. Bendixsen was a member of India House in New York and the Skytop Club of Pennsylvania. He leaves his wife and two children.

Philblack A Redesignated

Philblack A is now to be classified as a MAF (Medium Abrasion Furnace) black, according to a recent announcement made by Amos W. Oakleaf, sales manager of the Philblack division of the Phillips Chemical Company. The former designation was as a HMF (High Modulus Furnace) black. The revision has been initiated by Phillips Chemical to clarify Philblack A's position in the present confusing situation in which two distinct types of carbon blacks, in two distinct price ranges, are classified as HMF blacks. The new classification, Medium Abrasion Furnace, was selected as that aptly describing a most significant property of Philblack A (and similar blacks) in overall rubber compounding aspects. Since Philblack A imparts to rubber compounds abrasion resistance exceeded only by the HAF type blacks (also classified as RF and VFF blacks) and channel blacks, the new term, MAF, is considered to be appropriate and adequate.

Neoprene Latex Type 735

A new type of neoprene especially developed for treating paper, and a mill-tested process for adding it to pulp to increase the strength and chemical resistance of finished paper, have been announced by E. I. du Pont de Nemours & Co., Inc. The product, Neoprene Latex Type 735, and the process were developed in the laboratories of the company at Deepwater Point, N. J. The addition of a small amount of the new neoprene to paper stocks is said to produce papers of outstanding wet strength. They are also said to possess unusually high breaking elongation, high tensile strength, and excellent resistance to folding and tearing. Papers treated with the new neoprene also display considerable resistance to a variety of chemicals.

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NEW EQUIPMENT

Baldwin Model 60-8 Testing Machine

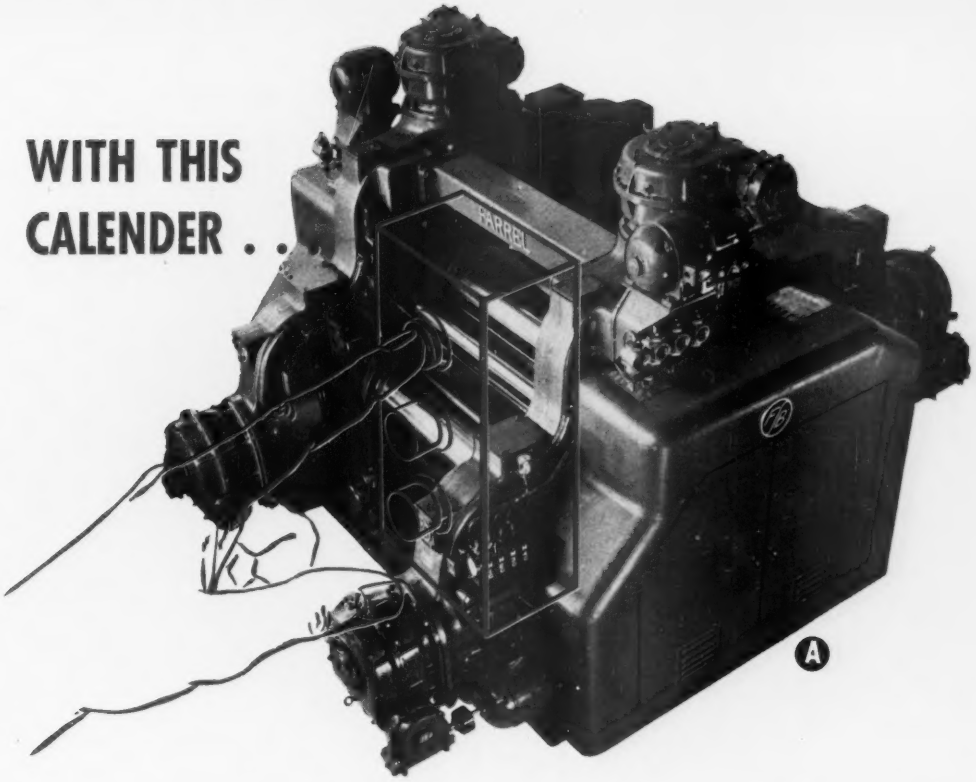
An improved, low-cost universal testing machine, Model 60-8, of 60,000 pound capacity with two ranges, is now in production by the Baldwin Locomotive Works, Philadelphia 42, Penna. Designed like larger Baldwin machines with the hydraulic loading unit separate from the indicating and control unit recoil from breaking specimens is isolated and maximum or lazy hands can be adjusted with minimum drag. The two-unit design also permits varying their relative positions to suit any requirement.

The two-unit design of the new Baldwin Model 60-8 testing machine permits varying their relative positions to suit specific requirements.

Another feature of the new machine is its rigid, two-column design which gives high accessibility in handling specimens and simplifies observations. Load, either in tension or compression, is applied by an integrated piston and elevating cage consisting of the table, two uprights and upper gripping head, all of which have a 6-inch stroke. The lower gripping head is the upper member of a second, adjustable cage including two long columns and lower crosshead supported by a vertical screw extending downward from the closed end of the hydraulic cylinder.

The 60,000 pound range is graduated in 100 pound units on a 16-inch diameter indicator dial and a 12,000 pound range is graduated in 20 pound units. Bourdon gages for both ranges are precision Emery type, with accuracy within 1% or one dial division, whichever is greater. They are connected with the loading cylinder. A standard Baldwin recorder can be used with the machine if desired.

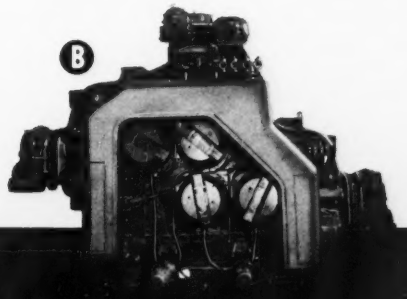
WITH THIS CALENDER . . .



. . . you simply push a button to vary roll "crown"

A Farrel-Birmingham Z-type calender was developed for production that demands extremely accurate gauge and temperature control. Plastic film is being produced regularly on the Z-type calender with a variation in thickness of only *plus or minus .0001".*

B View showing the Z arrangement of rolls and connections for universal spindles from the uni-drive. Preloading devices eliminate backlash and hold the rolls firmly in their operating positions.



A unique feature of Farrel-Birmingham's new Z-type calender is its ability to handle a wide variety of stock compositions, at varying speeds, with extremely close control of temperature and gauge.

A built-in device for crossing the axes of the rolls compensates for roll deflection. Crossing the rolls (which is closely equivalent to varying the roll crown) is accomplished quickly by push-button control.

For film production, the two lower rolls are equipped with this device to adjust the rolls accurately for the final pass. For double coating, this feature can be installed for both upper and lower bank passes.

Among the many other advantages of this calender are: (1) Vertical pressure from a third roll cannot affect roll settings, (2) positive roll positioning provided by hydraulic pullbacks, and (3) in film production, exposure of material in initial passes limited to a 90° arc of roll surface.

Write for further information about this unique calender, or for engineering assistance on your machinery problems.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y. *Sales Offices:* Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

FB 583

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RED 347
Slightly Deeper Mass Tone with Blue Cast
RED 387
Still Deeper Mass Tone — Bluer Cast
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For wide variety of uses, high quality and uniformity these clean, bright reds are stand-outs. New, highly modernized plant and equipment and precise production controls have made them better than ever. Note these desirable characteristics.

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- Easy dispersion and processing
- Color permanence
- Exceptional strength
- Unusual purity
- Fine particle size
- Good aging behavior
- Moderate reinforcement
- Spheroidal particle shape
- Tear and flex resistance

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- Footwear
- Rubber hose
- Drug items
- Sundries
- Chemical goods

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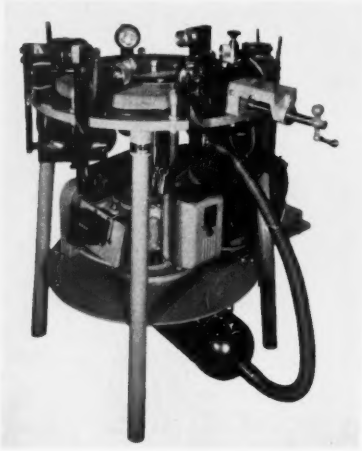
Improved Goodyear Angle Abrader

Scott Testers, Inc., Providence, Rhode Island, announce that they are now producing a standard model of the "Goodyear Angle Abrader" as developed by the Goodyear Tire and Rubber Co. at Akron, Ohio. Designed for the abrasion testing of tire tread compounds the machine as manufactured by Scott Testers incorporates certain features evolved by the J. M. Huber Corporation for evaluating the effects of carbon black.



The abrader accommodates up to 8 samples at once. Each sample is positioned on the flat face of a vitreous Alundum grinding wheel which is rotated on a vertical shaft at a standard speed of 80 r.p.m. The specimens are pressed against the wheel by a standardized 32-pound weight. This mass creates a friction which causes the specimen to rotate on the wheel in a shearing action. A pre-set counter stops the test automatically after the predetermined cycle.

In loading the machine, samples are slid over a revolving hub and fastened thereon between two washers by a knurled securing nut. For ease of loading, a specially constructed cam lifter has been provided for each specimen holder. These also serve to elevate the individual holders above the test area when they contain no sample. The holder provides for varying the shearing angle and it is possible to adjust for other weightings than the 32 lb. standard.

To eliminate possible contamination, the material removed by abrasion is immediately exhausted by a vacuum cleaner which has an individual intake for each specimen. A fixture holding a diamond dressing tool is permanently installed to maintain a plane and uniform surface on the test face of the wheel. The entire apparatus is a self-contained unit, operated from a single push button panel.

Results from this type of tester are said to have evaluated tread wear in values comparable with actual road tests. The evaluation of the result is the original weight of the sample vs. the weight at the end of the cycle.

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R. D. Wood 570-ton self-contained press for general use in molding rubber or plastic products, or for laboratory service.

R. D. Wood 3400-ton two-opening steam platen press for vulcanizing and curing rubber composition sheet packing, floor tile, and rubber belting.

You get from an R. D. Wood hydraulic press *engineered performance*—year after year!

You get this proved performance because R. D. Wood hydraulic presses are very carefully designed and built—with only the finest materials used in their construction.

You get this performance—with all its obvious economies—because 150 years of manufacturing experience go into each piece of R. D. Wood equipment.

Whatever your hydraulic press needs or problems might be, get in touch with R. D. Wood engineers. Let them show you how *performance* makes a Wood press a good press.

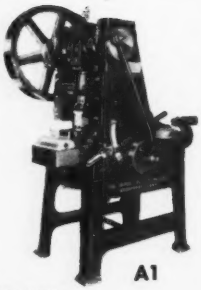
HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE • ACCUMULATORS • ACCUMULATORS • INTENSIFIERS

EST. 1803

R. D. Wood Company

PUBLIC LEDGER BUILDING PHILADELPHIA 6, PA.

For MORE than Half a Century the name COULTER has meant M O R E in higher quality cuttings . . . MORE IN GREATER PRODUCTION. So much MORE that . . .

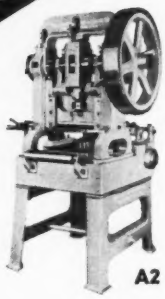


A1

Men who Know PRODUCTION MACHINES Choose

the James COULTER Machine Co.
BRIDGEPORT, CONN.

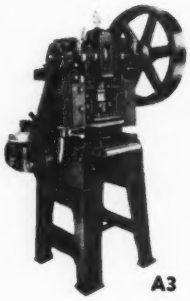
MODEL A-1
Cutting Heels at high speed production or short runs.



A2

MODEL A-2
Cutting Multiple Heels, Half and Full Soles with stock grain.

MODEL A-3
Cutting Multiple Heels and Taps with or across stock grain.



A3

MODEL A-2s
(Not illustrated)
Cutting across grain of stock.

COULTER PRODUCTION MACHINES SINCE 1896

Schori Process Spray Pistol

The need for a simple process to produce a film or coating to facilitate evaluation of new materials or processes, has inspired the Schori Process Flame Spray Powder Pistol, produced by the Schori Process Division of the Ferro-Co Corp., 8-11 Forty-third Road, Long Island City 1, N. Y. The pistol may be used to spray

The Schori Pistol shown will spray plastics, pigmented powders, protective coatings, etc.

pigmented powders, plastics, mixtures, or blends of materials; protective coatings such as chemically resistant linings on tanks; conductive films of metals on plastics, or non-conductive films of plastic on metals, etc. The Model L Pistol, depicted herewith, will spray any powdered metal or thermoplastic resin or combination of the two. As little as 50 grams of powder will produce a coating that can be subjected to test.

SEE PAGE 608

RUBBER & PLASTICS MACHINERY BULLETIN

Reporting News and Machine Design Developments

IN BUSINESS TO **NRM** REDUCE YOUR COSTS

Maximum Efficiency Calls For Special Extruder Screws

There is no such thing as a "standard" extruder screw where maximum efficiency is demanded. That's why NRM sells so many screws for other makes of tubers. Many factors enter into screw selection: the compound to be extruded, the cross section, tolerance and desired production rates. Long experience and close observation of extruder performance throughout the rubber and plastics field provides NRM engineers with an accurate guide for designing screws for specific jobs.

Production Quality Depends on Design of Screw

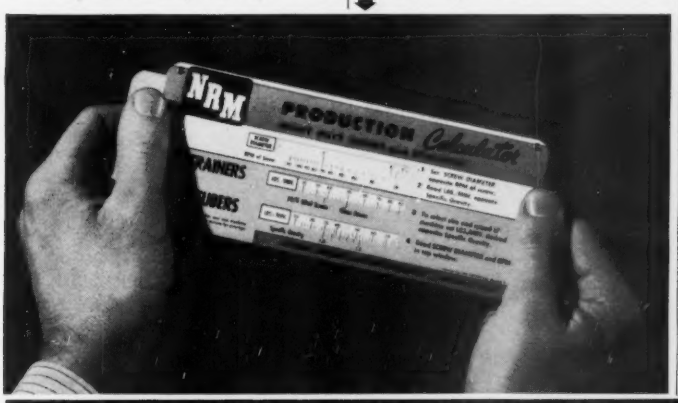
Rate, uniformity and density of the extrusion; horsepower consumed and heat generated in the stock are all affected by screw design and system of temperature control. These factors do not always have the same relation to each other due to variations in compounds. Therefore, selection of best screw characteristics is not an exact science, but depends largely on experience gained from working with many installations.

NRM offers you the benefit of such experience! Perhaps your present compounds are different than they were when you bought your extruders. It can pay you well to check the efficiency of your present screws. Consult with NRM—one of our many varieties may reduce your costs!

New Extrusion Production Calculator Available

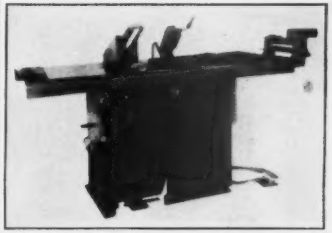
Now—NRM Engineers have developed a simple (see photo below) but accurate production calculator based on NRM extruder and strainer performance. With the calculator one can quickly determine output in lbs., horse power for various screw speeds taking into consideration the gravity of the stock.

To get your calculator write NRM in Akron Ohio (address below). Please use company letterhead and give title.



WELDSTITCH TUBE SPLICER For Industrial Tire Inner Tubes

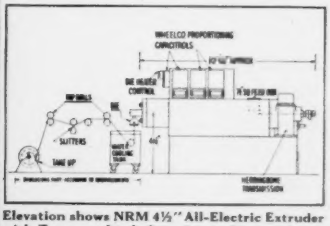
Industrial tire tubes are mostly still hand spliced because this operation has always presented a difficult problem. Now you can get a special NRM Weldstitch splicer for small diameter tubes. The NRM splicer does the job efficiently and economically. Rejects are reduced to a minimum.



The Tube Splicer (shown above) derives its name, "Weldstitch" from the appearance of the butt-spliced joint. Special serrated jaws knit the tube ends together—making an impression similar to stitches. The Weldstitch process is licensed. A larger machine is available for passenger and truck tubes up to 21" flat width. *Write for detailed information.*

POLYETHYLENE SHEETING? YOU CAN EXTRUDE IT YOURSELF AND SAVE

Tire manufacturers are using more and more polyethylene film in place of other materials for protecting tacky surfaces such as camelback. It is also used to protect white sidewalls of tires and for many other purposes.



Elevation shows NRM 4½" All-Electric Extruder with T-type polyethylene die, cooling tank, nip rolls and take-up.

Where sizeable quantities are used, big savings can be made by purchasing polyethylene pellets and extruding the film. NRM provides complete polyethylene extrusion units including cooling tanks, wind-ups and embossing attachments.

NATIONAL RUBBER MACHINERY CO.

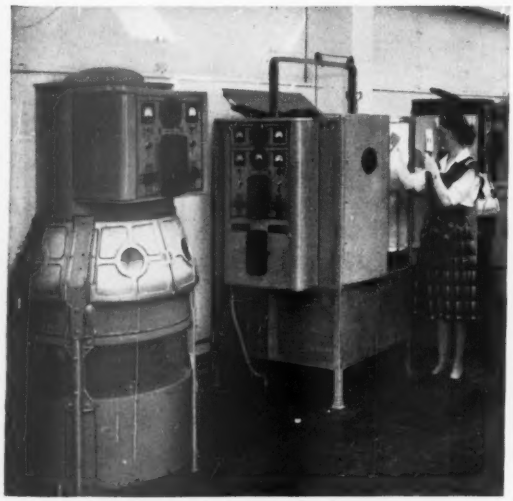
General Offices & Engineering Laboratories
Akron 8, Ohio

PLANTS at Akron and Columbiana, Ohio and Clifton, N. J.
AGENTS East: National Rubber Machinery Co., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Calif.
EUROPE Rubber Machinery: GILLESPIE & COMPANY
96 Wall Street, New York 5, N. Y.

Creative Engineering

ATLAS-OMETERS

. . . used in Quality Control for plastic or rubber products at B. F. Goodrich Company



An important part of the tests at B. F. Goodrich Company Laboratories involves subjecting products to the destructive effects of weathering conditions they will be expected to meet in service. By using Atlas Fade-Ometers and Weather-Ometers it is often possible to obtain quickly, in advance of actual service, assurance that new materials will have satisfactory resistance to cracking, sun-checking, chalking, fading or bleeding of color, or to loss of elastic properties.

In the Fade-Ometer—used to check the reaction of any material or type of finish to the deteriorating effects of sunlight—plastic materials such as Koroseal are tested for permanence of bright color. The Weather-Ometer—which accurately duplicates rain, heavy dew, sunlight and thermal shock—offers complete control of these elements so that any desired climatic cycle can be obtained. Results of tests in the Weather-Ometer are used in the evaluation of the aging and weathering characteristics of rubbers and plastics under accelerated conditions corresponding to outdoor exposure.

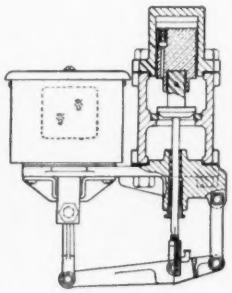
The machines are easy to operate, fully automatic, and may safely be left in continuous operation overnight without attention from the operator.

ATLAS ELECTRIC DEVICES CO.
361 West Superior St., Chicago 10, Illinois
WEATHER-OMETERS • FADE-OMETERS • LAUNDER-OMETERS

Johnson Solenoid Valve

To eliminate the water hammer that can result from the sudden closing of a valve in a high velocity pipe line, the Johnson Corporation, Three Rivers, Mich., has developed a special dash pot design now available in its line of direct operated solenoid valves. The new valve is known as Series No. 4000, and is designed for normally closed operation. It slows down the closing action of the valve 1½ to 2 seconds.

Dash pot construction consists of a bronze piston fitted within the top housing of the valve, and pinned to the valve to follow its movement. An upward seating ball check controls the flow through a port in this piston. When the valve is opened, and the piston moves up, liquid above the piston flows freely through the port so there is no resistance to the instant opening of valve orifice. When the valve closes, however, the ball check closes the port; liquid must then flow between the piston and the housing, a restricted passage which slows the closing of the valve. Piston and valve are independent of the action of the valve-opening push rod.



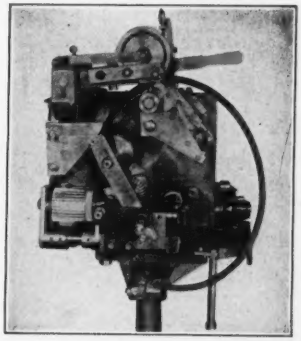
The new Series No. 4000 is built for heavy duty service. It has no auxiliary pistons to expose close tolerances to silt laden liquids. It handles temperatures up to 400° F., and smaller sizes will operate under differential pressures up to 150 pounds. Solenoids are rated to provide unusual reserve factor. The body is bolted together for maximum strength, and for easy access to all operating parts.

Yours For The Asking
INDUSTRIAL APPLICATIONS *of* FINELY GROUND **Mica**
WATER GROUND AND MICRO MICA
THE ENGLISH MICA CO.
STERLING BUILDING, STAMFORD, CONN.

Utility Crimper Type Flipper

for

Truck and Large Balloon Tires



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Long Distance Phone Call

MILWAUKEE—SHERIDAN 4-7020

RANDALL & STICKNEY

Hand Grip Rubber Gauge No. 3-B

Height .....9"	Length .....9¾"	Range .....½"
Depth of Throat ....6½"	Dia. 50 Divisions Each Div. 1/1000"	Weight ....4 lbs. Frame Aluminum

Designed for gauging stock as it is coming from the calender.

FRANK E. RANDALL CO., Waltham 54, Mass.

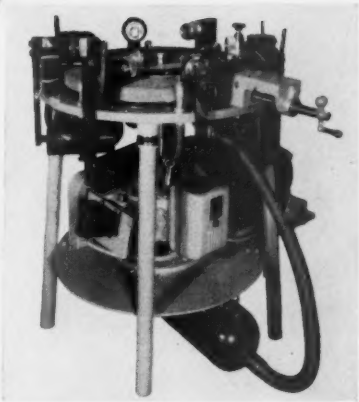
TESTED IS TRUSTED

New--- Angle Abrader

RUBBER

PLASTICS

ELASTOMERS



"To evaluate Tread Wear in values comparable with actual road tests"

Available for the first time as a standard unit from an instrument manufacturer, the Goodyear Angle Abrader provides for simultaneous testing of up to 8 samples—with automatic stopping of test at end of cycle. Specimens are held at angle for shearing effect, at standardized 32 lbs. pressure, against rotating abrasive wheel—with test results comparable to actual tread wear tests. (Developed by Goodyear Tire & Rubber Co., Akron, Ohio.)

Details upon request

*Registered **SCOTT TESTERS** Trademark

SCOTT TESTERS, INC. 85 Blackstone St. Providence, R. I.

Standard of the World

T-C

TANNEY-COSTELLO
INC.
CABLE ADDRESS "COSTAN" AKRON
P.O. BOX 1112
868 E. TALLMADGE AVE.
AKRON 9, OHIO

Scrap Rubber
•
Natural Rubber
•
Plastic Scrap

Representatives for:
S. J. PIKE & CO., INC.
Crude Rubber Importers
30 Church Street
New York 7, New York

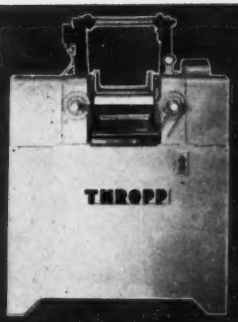
Clark Aluminum Tread Tray Truck

Primarily designed and manufactured for use in the rubber industry for the handling of tire tread extrusions, the Clark Aluminum Tread Tray Truck manufactured by the All Steel Welded Truck Co., Rockford, Ill., has trays that can be moved with a flip of the finger. The trays are built of a very hard Alclad aluminum sheet. The deck of this tray will not sag or bend

out of shape and its strength is said to be greater than steel. Pivot pins electrically welded to steel brackets which are riveted to the frame make the tray practically unbreakable. Trays are set into slotted arrangements to prevent breaking of corners and held in place with special springs. Three special rubber bumpers on the outer edge of the trays provide a cushion effect when the trays are lowered, and also lock trays in raised position holding them securely so that only one tray may be lowered at a time.

Large wheels, hard composition covered, are said to provide maximum of floor protection and easy rolling. Standard equipment includes Hyatt roller bearings and grease fittings. Wheel journals are electric welded to the channel frame of the truck. Casters are of heavy-duty fabricated steel with ball bearing swivel and Hyatt roller bearing wheels with composition tires. The truck may be had in one-sided arrangement of 36 trays or two-sided of 36 trays each. There is 1¼-inch clearance between trays. The wheels are 12 x 3 inches, caster wheels are 8 x 2½ inches. The frame, of heavy steel channel, is electrically welded into one complete unit, extending beyond the sides and ends of the trays for tray protection. Any tray may be removed and replaced without removing any parts or other trays. The hard surface trays can be cleaned with any solvent.

Mixing Equipment Co., Inc., Rochester, N. Y., has developed a new **heavy-duty liquid agitator** which can be moved quickly from one tank to another for batch mixing and blending. A single unit will serve up to 40 tanks, in any order desired. The agitator is a turbine-type unit containing all components necessary for complete and efficient batch mixing processes.



NEW LABORATORY MILL

6" x 12" with Anti-Friction Bearings

THE laboratory mill illustrated above was expressly designed as a precision mill for operation at high temperature (650° F).

A self contained lubrication system circulates oil through the roll journal bearings. The use of piston ring type oil seals eliminates oil leaks and the frequent replacement of rubber-based oil seals. Write for specification folder.

Capacity of mill: 2 to 3 pounds
Space required: 28" wide, 60" long.

- *West Coast Rep.:* H. M. Royal, Inc., 4814 Loma Vista Ave., Los Angeles, Cal.
- *Export Agent:* Steinhardter & Nordlinger, 105 Hudson St., N. Y.

THROPP

WM. R. THROPP & SONS CO. Trenton, N. J.

THE

SMACO GASKET SPLICER

SPLICER
VULCANIZER
EMBOSSER
MOLDER

Features

- SPEED
- NO BREAKDOWNS
- HEAT CONTROLS IN BOTH BRONZE PLATENS
- ONE OPERATOR — FROM 1 TO 8 UNITS
- LONG LIFE HEATERS AND THERMOSTATS

Ask ABOUT OUR HAND RUBBER CUTTER

For Further Information . . . . Write to

SIVON MACHINE & MFG. CO.
PAINESVILLE, OHIO

Designed To Extrude RUBBER or PLASTICS

IN these days of rapidly changing developments owners of Royle extruding machines are in the advantageous position of being able to adapt their extruders to either rubber or plastics production. If you are faced with the problem of extruding rubber and plastics the versatility of ROYLE extruders is of paramount importance to you. Whether you require a light or heavy production extruder features have been incorporated to assure maximum results. The change-over is quickly and simply accomplished.

Send for your copy of Bulletin No. 448. It describes these features and how they may be applied to older type extruders.

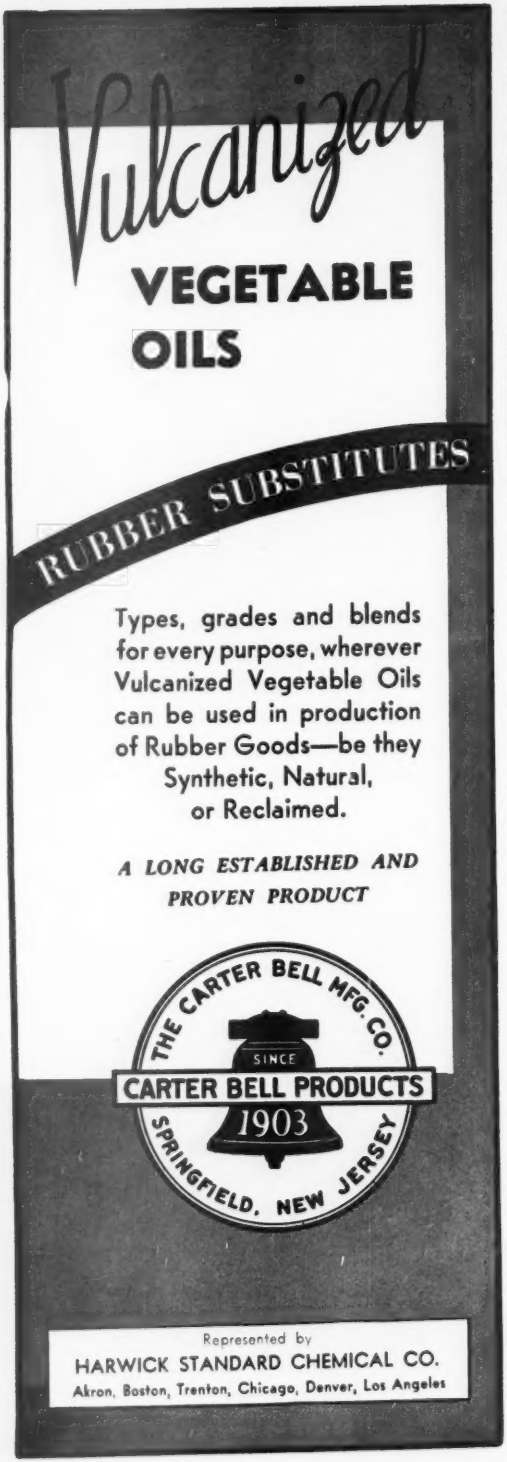
ROYLE # 2 Extruding Machine. Non-extended cylinder, plain tubing head.

JOHN ROYLE & SONS — ROYLE, PATERSON, N. J., 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England	Home Office	Akron, Ohio	Los Angeles, Cal.
James Day (Machinery) Ltd.	J. W. VanRiper	J. C. Clinefelter	H. M. Royal, Inc.
REgent 2430	SHerwood 2-8262	JEfferson 3264	LOgan 3261

PATERSON 3, NEW JERSEY


Vulcanized
VEGETABLE
OILS
RUBBER SUBSTITUTES
Types, grades and blends for every purpose, wherever Vulcanized Vegetable Oils can be used in production of Rubber Goods—be they Synthetic, Natural, or Reclaimed.
A LONG ESTABLISHED AND PROVEN PRODUCT
THE CARTER BELL MFG. CO.
SINCE
CARTER BELL PRODUCTS
1903
SPRINGFIELD, NEW JERSEY
Represented by
HARWICK STANDARD CHEMICAL CO.
Akron, Boston, Trenton, Chicago, Denver, Los Angeles

REVIEWS

BOOKLETS, CATALOGS, etc.

Chlorine Handbook. Diamond Alkali Co., Union Commerce Bldg., Cleveland 14, Ohio. 8½ x 11 in. 44 pp.

This handbook has been specifically prepared to help meet industry's need for basic data covering the safe storage, handling and use of chlorine as well as its physical properties. Liberally illustrated with graphic charts, drawings, tables and pictures, this quick reference technical manual holds particular interest for chemical and metallurgical engineers, works managers, superintendents and other process or plant executives responsible for storing, handling and using chlorine. The handbook describes and illustrates three approved, standard-size cylindrical containers used to package liquid chlorine for rail and truck shipment; gives "how-to-do-it" data on proper chlorine service tools, equipment and accessories; shows typical installations, and presents helpful information on first aid measures, gas masks and emergencies. The second section of the handbook is devoted entirely to a comprehensive yet concise review of the major physical properties of chlorine. Supplementing the discussion are eight charts and tables covering its enthalpy, vapor pressure, density, specific volume, solubility and viscosity. The enthalpy-temperature diagram for liquid chlorine is said to represent the first one presenting comprehensive data of this type.

•

Stretching Highway Dollars with Rubber Roads. By Harry K. Fisher. Natural Rubber Bureau, 1631 K Street, N.W., Washington 6, D. C. 6 x 9 in. 28 pp.

A brief progress report on recent developments in the use of natural rubber for road construction is presented in this booklet. The booklet discusses the first test strips laid down in Virginia, Ohio, Texas, Minnesota, and in Canada. The techniques evolved and used on each of the test strips, the mix recipes, and results to date are elaborated upon. Charts, tables, photographs and drawings illustrate the text material.

•

Fatigue Allowance in Industrial Time Study. By Matthew A. Payne, 13777 Euclid Avenue, East Cleveland 12, Ohio. 6 x 9 in. 66 pp. $2.50.

This booklet is said to be the first to exclusively present and discuss problems associated with the purpose, determination and application of the fatigue allowance in industrial time study. It contains many of the finest industrial engineering opinions concerning fatigue allowance and its effect upon workloads, fair day's work, manpower and incentive assignments. The booklet contains 65 direct quotations and 85 references.

•

Low-Speed Synchronous Motors. (GEA-5332). Apparatus Department, General Electric Co., Schenectady 5, N. Y. 8½ x 11 in. 8 pp.

Typical installations of high-power factor, constant-speed drives are illustrated in this bulletin. Construction features of the units are described, and mechanical modifications and performance data are indicated. Covered are Type TS (3-phase) and Type QS (2-phase) motors in the 6000 series with frame sizes of 6184 and larger, and ratings from 20 to 15,000 h.p.

•

Electrostatic Precipitation. (GEA-5212). Apparatus Department, General Electric Co., Schenectady 5, N. Y. 8½ x 11 in. 16 pp.

Profusely illustrated with photographs and diagrams, this bulletin explains how electrostatic precipitation works, gives case histories of seven typical installations where the system is being used, and describes the various methods of electrostatic precipitation and the electric equipment applicable to each method.

Hazacord Flexible Cords and Portable Cables. (Bulletin No. H-420). Hazard Insulated Wire Works Division of the Okonite Co., Wilkes-Barre, Penna. 8½ x 10 in. 56 pp.

Complete technical information and dimensional data are given in this manual covering the entire range of the company's flexible cords and portable cables, from the smallest 300-volt Type SJO cord to the largest 15,000-volt shovel cable, including welding cables, jumpers, motor leads and mining cables. Tables of current carrying capacities, resistance values and their correction factors are shown. An important section of the manual describes methods of splicing the various portable cable constructions. Clear diagrams show each step in the splicing procedure and are sufficiently complete to cover the most complicated portable cable construction. Constructions of the various cables are discussed in detail, with particular emphasis placed on the permanent protection which is provided. Typical test values are given for the insulations and sheath to assist users in choosing the proper construction for specific applications. Fully illustrated with actual photographs taken in the plant and in the field, the manual also describes the research and manufacturing methods employed, as well as the many difficult services in which flexible cords and portable cables are used.

•

Use of Dustube Dust Collectors in the Manufacture of Rubber Goods. (Bulletin No. 242). American Wheelabrator & Equipment Corp., 728 S. Byrkit St., Mishawaka, Ind. 8½ x 11 in. 4 pp.

This bulletin takes up the twin problems of nuisance dust and the recovery of usable powdered materials in rubber manufacturing operations. The solution to this problem, by effective hooding and piping arrangements which trap dust at the source and prevent it from being dispensed to the working area, is explained in detail. Photographs and drawings are used to explain the use of Dustube Dust Collectors in obtaining best operating results.

•

Industrial Applications of Finely Ground Mica. English Mica Co., Inc., Sterling Building, Stamford, Conn. 8½ x 11 in. 6 pp.

As indicated by its title, this brochure discusses the industrial applications of finely ground mica, including specific uses in the rubber industry. In addition, the various types of mica available are listed and data furnished on both chemical analysis and physical properties. An actual sample of a typical mica flake is included with the brochure.

SEE PAGE 608

The Institution of the Rubber Industry

LONDON

THE RUBBER INDUSTRY owes its development largely to scientific and technical research and the Institution was founded in 1921 to foster scientific and technical advancement and to disseminate the results.

THE INSTITUTION TODAY is the centre of a great fraternity of rubber manufacturers, scientists, technologists, research establishments, executives and students from every country whose object is the advancement of the cause of the rubber industry throughout the world.

OBJECTS: To promote corporate and concerted effort in the industry by bringing together all those engaged or interested in the various branches of science and technology on which the Industry is based and co-ordinating their respective contributions.

To promote the profession and practice of Rubber Technology.

To encourage the extension of scientific and technical education in the principles and details of rubber manufacture.

To maintain a scheme of Diplomas for the recognition of efficiency in knowledge of all branches of technology essential to the successful maintenance and development of rubber manufacture.

To arrange for the holding of meetings, the reading of papers and the giving of lectures with subsequent discussions and publications.

To foster the systematic study of scientific and technical problems involved in the various phases of the manufacture of natural and synthetic rubbers and rubber-like materials and their conversion into finished products.

To encourage original work and research dealing with the manufacture of rubbers.

PUBLICATIONS.

The Transactions: Bi-monthly record of scientific and technological investigations in the realm of rubber and its allied industries.

Annual Report on the Progress of Rubber Technology: containing systematic accounts of the developments in rubber technology from year to year.

Proceedings of Rubber Technology Conferences.

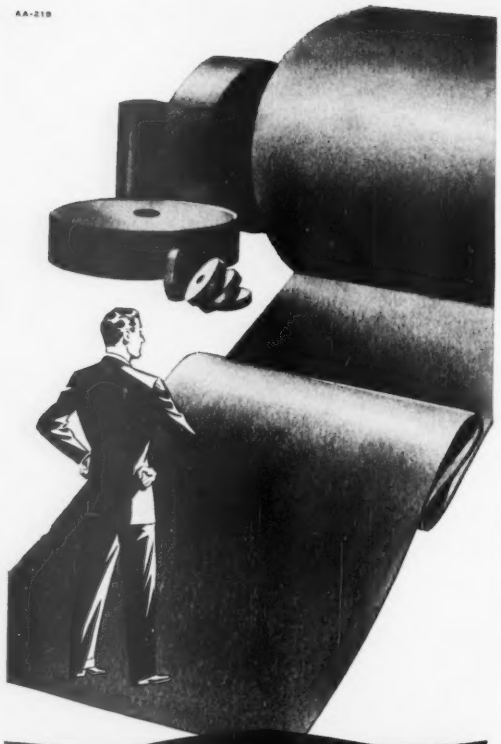
INVITATION TO MEMBERSHIP.

At this time of progress and expansion in the affairs of the Institution, its Council, conscious of the benefits that lie within the sphere of the Institution, invites applications for the privilege of membership from those engaged or interested in the Rubber and its allied industries.

Application forms and full particulars may be obtained from:—

THE REGISTRAR
INSTITUTION OF THE RUBBER INDUSTRY
12, WHITEHALL
LONDON, S.W. 1, ENGLAND

AA-219



HOW TO MAKE
BETTER ROLLS
OF ANY SIZE • ANY MATERIAL

Whether it's rubber, fabric, paper or plastic film – (thin, heavy, plain or sticky) – there is a *right Camachine* slitter-rewinder for producing clean-cut, accurately measured, firmly wound rolls.

Better rolls make better, more attractive packages. Better rolls simplify and reduce the cost of additional processing.

Camachine slitter-rewinders provide top quality production at exceptionally high speeds, and can often effect substantial savings in your roll winding costs.

Camachine engineers have been providing the right answers to a great variety of roll-engineering questions for the rubber industries for more than fifty years. You are invited to write for specific information regarding any slitting and roll winding problem.

CAMERON MACHINE COMPANY • 61 Poplar St. • Brooklyn 2, N.Y.

Camachines FOR FAST, TOP QUALITY ROLL PRODUCTION
. . . the world over

REVIEWS (CONT'D)

Vinylite Vinyl Butyral Resins. (Technical Release No. 11). Bakelite Corp., Unit of Union Carbide and Carbon Corp., 300 Madison Avenue, New York 17, N. Y. 8½ x 11 in. 24 pp.

The information contained in this technical booklet should enable manufacturers to immediately utilize Vinylite vinyl butyral resins in the preparation of coatings and adhesives. The general properties of the resins, their compatibility and solubility are covered. Sections of the booklet are devoted to the applications of the resins in the bonding of rubber, cork, wood, asbestos, metal, etc., and in coatings. Various tables and charts are provided to supplement the text material.

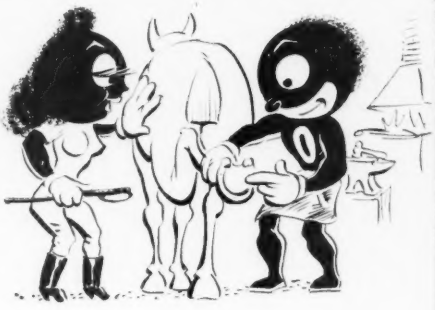
Division of Rubber Chemistry, A.C.S.

(Continued from page 674)

ture and chemical nature of the carbon black surface, resulting in particularly strong bonds between the carbon particles and the rubber molecules. It was hoped that some information on this subject might be obtained by an investigation of the effect of a number of substances of widely different chemical nature, in a state of fineness and distribution approaching or surpassing that of reinforcing carbon blacks. It was attempted to accomplish the desired degree of pigment dispersion and distribution in rubber (GR-S) by incorporating the pigments into rubber latices in the form of colloidal solutions and drying the mixture.

The following pigment materials were investigated with regard to their effect on various physical properties of GR-S: colloidal stannic oxide, silica, ferric-ferrocyanide, polystyrene and casein. It was found that all of these materials increased the tensile strength and modulus of GR-S to different extents. Colloidal stannic oxide produced the highest degree of tensile and modulus reinforcement, exceeding that obtained with equal volumes of EPC (easy processing channel) carbon black. The extent of tensile reinforcement appeared to be influenced by the particle size of the different colloidal pigments.

It was shown by means of the electron microscope that the masterbatches, obtained by drying of mixtures of GR-S latex and silica hydrosol, consisted of discrete, closely packed latex particles of the original size, the voids between the latex particles being occupied by agglomerated colloidal silica particles, forming a continuous structure. Milling of the masterbatch caused this structure to break up into smaller fragments and into individual spherical silica particles of the original colloidal size.



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SEE PAGE 608

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MARKETS

Rubber – Crude, Reclaimed and Scrap – Cotton – Ducks – Tire Fabrics – Sheetings

NEW YORK, MARCH 8, 1950

Natural Rubber

A steady advance has marked the price of spot rubber on the Commodity Exchange since our last report (February 7). The high for the period was 19.75 cents reached on March 7, while the low was 19.25 cents reached on February 10, a variance of 50 points. The average price of spot rubber for the month of February was 19.40 cents based on 18 trading days. In the previous month the average price of spot rubber was 18.33 cents.

The underlying strength in the natural rubber market can be partially attributed to the persistently high rate of consumption in the United States. The strong position of the market can also be attributed to the fact that manufacturers are attempting to build up their inventories in the anticipation of labor unrest. There is also some apprehension that synthetic rubber may not be available in the quantities desired for some time.

It is believed that a new Indonesian incentive program will be instituted in the near future. This program will call for permissible withholding of currency of the country to which rubber is exported to the extent of 33%. Should this be correct, it would act as a stimulus to Indonesian exporters to direct surplus rubber shipments to this country in the hopes of accumulating a dollar reserve.

Today's quotations on the outside market, London and Singapore, follow:

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.19⅝
March	.19½
April	.19⅜
Thin Latex Crepe:	
Spot	.23¼
April-June	.23
Thin Brown Crepe, No. 2	.19¾
Ambers, No. 3	.19¼
Flat Bark Crepe	.18¼

London Market

(Standard Smoked Sheets)

April	18.81 - 18.96
July-Sept.	18.08 - 18.16

Singapore Market

(Standard Smoked Sheets)

April	17.24 - 17.28

Synthetic Rubber

(Dry Types-Per Pound)

Butaprene NF	.440 - .450
Butaprene NL	.450 - .460
Butaprene NAA	.490 - .500
Butaprene NXM	.520 - 530
Chemigum 30 N4NS	.400 - .470
Chemigum 50N4NS	.400 - .470
Chemigum N3	.450 - .520
GR-I	—— - .185
GR-S	—— - .185
Hycar OR-25	.450 - .460
Hycar OR-15	.520 - .530
Hycar OS-10	.500 - .510
Neoprene Types CG and AC	—— - .500
Neoprene Type E	—— - .650
Neoprene Types FR and KNR	—— - .750
Neoprene Type GN	—— - .320
Neoprene Type GN-A	—— - .320
Neoprene Type RT	—— - .350
Neoprene Type S	—— - .320
Neoprene Type W	—— - .350
Paracril 18	.430 - .450
Paracril 26	.440 - .460
Paracril 35	.510 - .530
Silastic (compounded)	2.35 - 4.40
Thiokol Type A	.370 - .470
Thiokol Type FA	.520 - .620
Thiokol PR-1	.750 - .850
Thiokol Type ST	.750 - .850

Scrap Rubber

Scrap rubber continues to move at a fairly steady pace continuing an improvement in market conditions which has been evidenced during the past few months. Advances in natural rubber prices have acted as a stimulant on the market. Optimistic estimates for the next few months continue to be heard. Prices for scrap rubber have not been adjusted during this past period. Current quotations follow:

Mixed passenger tires	ton	$13.00
Beadless truck tires	ton	nom.
Mixed truck tires	ton	15.00
Beadless passenger tires	ton	nom.
No. 1 passenger peelings	ton	42.50
No. 1 truck peelings	ton	42.50
Red passenger tubes	lb.	.07
Black passenger tubes	lb.	.04
Mixed passenger tubes	lb.	.04
No. 2 truck tubes	lb.	nom.
Red truck tubes	lb.	.07
Black truck tubes	lb.	.03½
Buffings	ton	15.00

Reclaimed Rubber

Consumption for reclaim for 1949 has been estimated at 222,903 long tons by the Department of Commerce. This compares with 261,113 long tons consumed in 1948. The coal strike had little effect on the demand for reclaim as most rubber companies were well supplied with coal. In general, business continues at a brisk level. A let-up in demand is not anticipated at this time. Prices have not been adjusted during the period. Current quotations follow:

Tires

Black, Digester (Natural)	lb.	.08¾ - .08¾
Peels No. 1	lb.	.08¾ - .08¾
Whole Tire (Blend)	lb.	.08¾ - .08¾

Inner Tubes

Black (Natural)	lb.	.11½ - .12
Red (Natural)	lb.	.13½ - .14½
Butyl	lb.	.08¾ - .08¾

Shoe

Unwashed (Natural)	lb.	.08¾ - .09¼

Cotton Tire Fabrics

The demand for cotton tire fabrics has been on the increase and this has been attributed, in some quarters, to inadequate supplies of synthetic fibers. This condition, however, is viewed as temporary. Increased demand should continue for the next few months, according to trade sources. Some small price rises were announced during the past period. Current quotations follow:

Standard, Peeler, 12/4/2	lb.	.68
Standard, Peeler, 14/4/2	lb.	.70
Standard, Peeler, 16/4/3	lb.	.7250
Extra Staple, Peeler, 12/4/2	lb.	.8315
Extra Staple, Peeler, 14/4/2	lb.	.8575
Extra Staple, Peeler, 16/4/3	lb.	.8825

Chafers

14.4 oz. (per sq. yard)	lb.	.67
9.25 oz. (per sq. yard)	lb.	.63
11.65 oz. (per sq. yard)	lb.	.60
8.9 oz. (per sq. yard)	lb.	.6475

Cotton

The price of middling uplands on the Cotton Exchange has moved in a range of 72 points since our last report (February 7), high for the period being 33.22 cents reached on March 3, and low being 32.50 cents reached on February 8. The average price of middling uplands for the month of February was 32.79 cents based on 22 trading days. This compares with an average of 31.89 cents for the preceding month.

The Senate has passed the cotton acreage bill which would expand the present 21,000,000 acre allotment by 600,000 to 700,000 acres. The bill now goes to conference with a House passed bill which would expand the allotments from 1,400,000 to 2,000,000 acres more than the original total. However, the law, when passed, is not expected to have much effect on the total planted, because farmers must voluntarily give up their unused allotments for redistribution to other farmers.

The Department of Agriculture has announced it will sell 1948 crop stocks of Government-held cotton on a competitive bid basis but at prices not less than the Government's cost. Heretofore, sales have been held on a negotiated basis. Under the new plan, offerings will be made at intervals. The Government holds about 3,662,000 bales of the 1948 cotton that were placed under price-support loans by growers at an average of about $150 per bale.

The Economic Cooperation Administration has informed Congress that no reduction in the amount of cotton financing to Europe is expected for the fiscal year beginning May 19.

Quotations for middling uplands on the Exchange follow:

	Feb. 7	Mar. 8		
	Close	High	Low	Close
March	31.46	31.86	31.66	31.74
May	31.49	32.26	32.16	32.22
July	30.94	32.16	32.05	32.14

Closing Rubber Prices on New York Commodity Exchange

(No. 1 R.S.S. Contract)

FROM FEBRUARY 8 TO MARCH 8

	Spot	Mar.	May	July	Sept.	Sales
Feb.						
8	19.50	19.10	18.66	18.15	17.95	118
9	19.38	19.05	18.70	18.20	18.00	17
10	19.25	19.30	18.96	18.40	18.30	110
11	——	——	——	——	——	——
12	——	——	——	——	——	——
13	——	——	——	——	——	——
14	19.50	19.37	19.00	18.40	18.30	82
15	19.62	19.40	19.05	18.70	18.55	187
16	19.62	19.55	19.40	18.95	18.99	77
17	19.62	19.50	19.35	18.95	18.90	54
18	——	——	——	——	——	——
19	——	——	——	——	——	——
20	19.62	19.45	19.25	18.85	18.73	144
21	19.50	19.25	19.15	18.70	18.68	69
22	——	——	——	——	——	——
23	19.38	19.25	19.20	18.75	18.55	30
24	19.38	19.15	19.02	18.71	18.55	57
25	——	——	——	——	——	——
26	——	——	——	——	——	——
27	19.50	19.35	19.12	18.73	18.60	74
28	19.50	19.22	19.12	18.77	18.64	8
Mar.						
1	19.62	19.40	19.15	18.82	18.70	31
2	19.62	19.50	19.15	18.87	18.75	37
3	19.62	19.30	19.08	18.70	18.60	14
4	——	——	——	——	——	——
5	——	——	——	——	——	——
6	19.62	19.75	19.47	19.05	18.93	37
7	19.75	19.30	19.15	18.75	18.70	79
8	19.62	19.50	19.28	18.88	18.70	80

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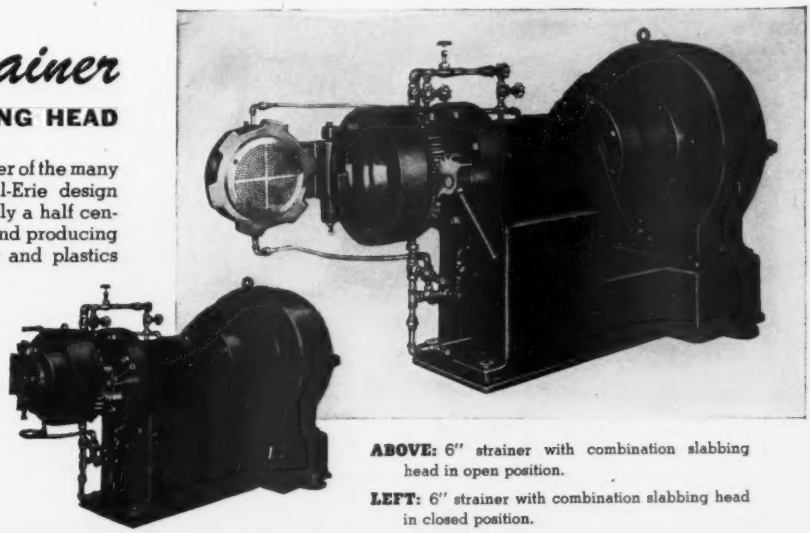

ABOVE: 6" strainer with combination slabbing head in open position.

LEFT: 6" strainer with combination slabbing head in closed position.

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STATISTICS *Of Interest to the Rubber Industry*

U. S. Imports and Re-Exports of Natural Rubber

	GROSS IMPORTS										RE-EXPORTS		TOTAL NET IMPORTS
	Natural Rubber (Dry)			Natural Rubber (Latex)			Guayule			Total Gross Imports			
Year	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Long Tons	Total Declared Value	Long Tons
1936	467,064	152,072,496	14.54	19,852	6,659,899	14.98	1,229	286,552	10.41	488,145	12,581	4,488,223	475,564
1937	574,600	237,307,041	18.44	23,185	10,213,670	19.67	2,694	745,873	12.36	600,479	7,902	3,385,433	592,577
1938	397,640	125,373,864	14.08	11,944	4,168,127	15.58	2,508	628,886	11.19	412,092	5,652	1,799,124	406,440
1939	469,946	167,586,780	15.92	27,437*	10,467,552	17.03	2,233	463,345	9.27	499,616	13,125	5,832,618	486,491
1940	781,202	303,308,823	17.33	33,789	14,593,466	19.28	3,633*	758,007	9.31	818,624	7,060	3,197,136	811,564
1941	989,498	401,976,317	18.14	34,797*	15,965,627	20.48	4,881	1,145,767	10.48	1,029,176	5,376	2,757,872	1,023,800
1942	266,276	112,537,426	18.87	10,646	5,630,667	23.61	5,523	1,660,792	13.42	282,445	10,856	5,913,386	271,589
1943	50,358	31,369,198	27.81	1,890	1,312,202	31.00	7,678*	3,636,789	21.14	59,926	22,583	16,446,707	37,343
1944	103,847	73,908,549	31.77	3,091	2,092,211	30.99	6,701*	3,351,233	22.33	113,639	9,739	8,712,695	103,900
1945	134,408	95,814,102	31.82	4,733	3,115,853	30.22	10,040	5,963,797	26.52	149,221	9,509	7,201,746	139,712
1946	366,415	222,552,939	27.12	8,421	5,843,085	29.14	5,344	2,859,246	23.89	380,180	7,711	5,331,954	372,469
1947	691,087	306,951,814	19.83	17,542	9,787,722	30.98	2,884	1,492,825	23.11	711,513	4,121	2,354,494	707,392
1948	702,293	290,849,177	18.49	32,745	9,820,080	24.93	302	71,330	10.53	735,340	6,672	3,259,324	728,668
1949	630,818	225,341,459	15.95	29,974	14,970,478	22.30	....	.....	....	660,792	6,253	2,746,109	654,539
1948:													
May	**37,227**	**14,409,747**	**17.28**	**3,442**	**1,915,744**	**24.84**	**40**	**9,435**	**10.53**	**40,709**	**1,031**	**485,941**	**39,678**
June	**62,376**	**25,338,739**	**18.13**	**2,288**	**1,335,173**	**26.05**	**60**	**14,152**	**10.53**	**64,724**	**718**	**348,043**	**64,006**
July	**60,070**	**25,206,980**	**18.07**	**1,654**	**2,002,902**	**24.48**	**100**	**23,587**	**10.53**	**61,734**	**466**	**243,774**	**61,268**
Aug.	**65,736**	**26,975,557**	**18.33**	**2,395**	**1,389,495**	**25.81**	....	.....	....	**67,771**	**520**	**268,912**	**67,251**
Sept.	**49,119**	**21,480,244**	**19.52**	**1,434**	**813,347**	**25.24**	....	.....	....	**50,553**	**514**	**229,016**	**50,039**
Oct.	**58,300**	**26,161,356**	**20.03**	**2,728**	**1,574,419**	**25.83**	....	.....	....	**61,028**	**675**	**320,570**	**60,353**
Nov.	**49,800**	**22,292,055**	**19.98**	**813**	**466,095**	**25.59**	....	.....	....	**50,613**	**772**	**249,315**	**49,841**
Dec.	**83,419**	**35,495,327**	**19.00**	**4,216**	**2,366,959**	**24.75**	....	.....	....	**87,635**	**569**	**250,540**	**87,066**
1949:													
Jan.	**66,575**	**27,037,698**	**18.13**	**1,132**	**634,165**	**25.02**	....	.....	....	**67,707**	**757**	**320,036**	**66,950**
Feb.	**55,234**	**21,549,791**	**17.41**	**2,159**	**1,030,107**	**21.30**	....	.....	....	**57,393**	**434**	**211,323**	**56,959**
Mar.	**53,768**	**20,095,422**	**16.68**	**2,809**	**1,564,383**	**24.87**	....	.....	....	**56,577**	**562**	**245,780**	**56,015**
Apr.	**48,262**	**18,167,840**	**16.85**	**2,271**	**1,219,404**	**23.97**	....	.....	....	**50,533**	**315**	**165,632**	**50,218**
May	**51,243**	**18,827,018**	**16.40**	**2,191**	**1,105,887**	**22.54**	....	.....	....	**53,434**	**390**	**181,457**	**53.044**
June	**49,038**	**18,084,566**	**16.47**	**2,180**	**1,113,169**	**22.80**	....	.....	....	**51,218**	**471**	**226,882**	**50,747**
July	**43,474**	**15,502,688**	**15.76**	**2,267**	**1,146,784**	**22.59**	....	.....	....	**45,741**	**699**	**289,896**	**45,042**
Aug.	**46,853**	**15,828,526**	**15.08**	**2,725**	**1,342,109**	**21.98**	....	.....	....	**49,578**	**251**	**110,368**	**49,327**
Sept.	**43,476**	**14,069,331**	**14.45**	**2,144**	**1,095,225**	**22.81**	....	.....	....	**45,620**	**556**	**248,921**	**45,064**
Oct.	**44,651**	**14,678,475**	**14.66**	**2,634**	**1,213,360**	**20.57**	....	.....	....	**47,285**	**404**	**160,047**	**46,881**
Nov.	**63,641**	**20,693,593**	**14.51**	**3,512**	**1,645,360**	**20.89**	....	.....	....	**67,153**	**11**	**9,002**	**67,142**

Source: U. S. Department of Commerce. * Adjusted to agree with total gross imports.

Notes: (1) Figures for latex are on a dry weight basis. (2) Figures for re-exports include natural rubber (dry and latex) and guayule. (3) In the years 1940 through 1943, crepe sole rubber imports were reported under a separate classification. Such imports, which are included under natural rubber, dry above, were: 856,294 pounds, valued at $191,097 in 1940; 379,607 pounds, valued at $85,924 in 1941; 662,503 pounds, valued at $159,530 in 1942; and 21,653 pounds, valued at $5,215 in 1943.

Natural Rubber
(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1936	**488,145**	**575,000**	**12,581**	**223,000**
1937	**600,479**	**543,600**	**7,902**	**262,204**
1938	**411,983**	**437,031**	**5,652**	**231,500**
1939	**499,473**	**592,000**	**13,125**	**125,800**
1940	**818,243**	**648,500**	**7,060**	**288,864**
1941	**1,029,007**	**775,000**	**5,376**	**533,344**
1942	**282,653**	**376,791**	**10,856**	**422,714**
1943	**55,329**	**317,634**	**20,815**	**139,594**
1944	**107,834**	**144,113**	**9,665**	**93,650**
1945	**135,672**	**105,429**	**6,743**	**118,715**
1946	**400,687**	**277,597**	**4,338**	**237,467**
1947	**658,354**	**562,661**	**4,101**	**129,038**
1948	735,227	627,332	6,673	141,541
1949	660,386	576,584	6,229	105,039
1948:				
Apr.	40,947	50,616	343	123,248
May	**40,709**	**52,022**	**1,031**	**112,724**
June	64,725	55,701	718	119,818
July	**63,775**	**48,769**	**466**	**128,446**
Aug.	68,131	53,366	520	129,622
Sept.	50,556	52,131	514	123,912
Oct.	61,027	49,617	675	118,187
Nov.	**50,671**	**51,632**	**746**	**113,251**
Dec.	87,634	45,985	569	141,541
1949:				
Jan.	67,706	50,188	757	125,050
Feb.	57,401	46,285	434	118,803
Mar.	**56,577**	**53,108**	**562**	117,664
Apr.	50,533	47,859	315	112,916
May	53,510	46,128	390	111,875
June	51,218	47,117	471	103,626
July	46,277	40,597	699	103,017
Aug.	49,579	45,307	251	99,850
Sept.	45,620	43,978	556	100,618
Oct.	47,285	51,243	404	90,733
Nov.	67,152	52,093	701	99,208
Dec.	67,528	52,681	689	105,039

Source: 1936-40, U. S. Department of Commerce; 1941 to date, Rubber Division, OMD, and Predecessor Agencies.

U.S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

	Balata		Jelutong		Gutta-Percha & Other Guttas	
Year	Tons	Value	Tons	Value	Tons	Value
1936	**535**	**199,368**	**6,163**	**1,296,364**	**1,568**	**555,643**
1937	**354**	**151,344**	**7,109**	**2,017,786**	**1,122**	**440,894**
1938	**509**	**181,148**	**9,132**	**2,944,504**	**444**	**204,582**
1939	**694**	**265,553**	**6,640**	**1,603,418**	**1,740**	**539,255**
1940	**648**	**300,500**	**7,451**	**2,449,137**	**2,340**	**1,004,885**
1941	**924**	**489,514**	**8,821**	**2,954,001**	**1,783**	**607,025**
1942	**1,544**	**1,107,059**	**1,200**	**530,296**	**804**	**525,763**
1943	**1,047**	**708,701**	**35**	**14,840**	....	.....
1944	**1,012**	**660,805**	**85**	**45,578**	**10**	**4,999**
1945	**1,361**	**907,253**	....	.....	**36**	**21,970**
1946	**2,281**	**2,233,065**	**304**	**256,169**	**423**	**458,064**
1947	**1,982**	**2,276,531**	**2,878**	**1,496,887**	**392**	**779,591**
1948	**1,195**	**805,078**	**3,401**	**2,377,765**	**423**	**542,788**
1948:						
Mar.	283	189,933	436	271,314	51	101,691
Apr.	82	36,570	651	393,280	52	68,366
May	**45**	**36,109**	**512**	**314,432**	**24**	**54,191**
June	67	36,885	277	211,373	45	41,277
July	120	87,327	205	170,949	15	35,001
Aug.	59	50,511	112	107,431	53	39,607
Sept.	91	67,970	112	83,432	0	0
Oct.	83	67,726	145	181,424	0	0
Nov.	**86**	**49,155**	**48**	**36,634**	**20**	**10,572**
Dec.	83	56,896	106	108,975	24	12,324
1949:						
Jan.	46	29,922	91	93,738	19	11,934
Feb.	65	53,665	77	91,362	9	16,328
Mar.	136	86,499	60	52,313	5	30,967
Apr.	88	48,244	14	8,753	16	9,878
May	103	60,361	85	83,291	..	.....
June	44	20,821	74	47,515	27	16,292
July	164	78,112	46	37,403	5	3,391
Aug.	137	66,002	114	96,509	5	2,218
Sept.	208	122,732	91	74,605	22	31,672
Oct.	222	142,538	123	92,681	19	15,221
Nov.	77	68,678	160	89,806	34	28,559

Source: U. S. Department of Commerce.

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Synthetic Rubber—Totals

(GR-S, Neoprene, Butyl, and Buna N Types)

(All Quantities in Long Tons)

Year	Production	Imports	Consumption	Exports	Stocks On Hand at End of Period
1941	8,383	.....	6,259	572	1,702
1942	22,434	.....	17,651	1,419	4,612
1943	231,722	.....	170,891	18,148	41,568
1944	762,630	11,043	566,670	104,266	142,927
1945	820,373	10,407	693,580	83,778	203,454
1946	740,026	7,709	761,699*	72,920	114,963
1947	508,702	1,093	559,566	11,385	62,366
1948	488,343	15,671	442,072	4,874	115,111
1949	393,690	17,245	414,053	6,488	98,205
1949:					
Jan.	38,890	927	36,765	623	118,357
Feb.	36,103	1,170	34,611	335	118,932
Mar.	36,063	1,436	38,746	963	116,843
Apr.	35,445	881	36,434	506	114,944
May	32,335	1,402	35,267	619	112,739
June	31,953	1,127	36,949	513	106,813
July	34,270	1,689	30,014	614	113,595
Aug.	33,885	1,745	35,630	369	111,333
Sept.	30,878	2,086	32,443	415	110,848
Oct.	28,015	1,497	33,687	420	103,955
Nov.	28,619	1,707	31,684	459	101,430
Dec.	27,234	1,578	32,277	352	98,205

Source: Rubber Division, OMD, and Predecessor Agencies.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures shown include the output of both government and privately-owned plants. (3) Figures for 1941 are estimated. * Includes year-end adjustment of 5,384 tons to cover non-reporting companies.

Synthetic Rubber—By Type

(All Quantities in Long Tons)

New Supply

	GR-S (Buna S)	GR-M (Neoprene)	GR-I (Butyl)	Buna N Types	Total
1942	3,721	8,956	23	9,734	22,434
1943	182,259	33,603	1,373	14,487	231,722
1944	679,949	56,660	20,252	16,812	773,673
1945	724,859	45,672	52,378	7,871	830,780
1946	613,408	47,766	80,823	5,738	747,735
1947	408,858	31,495	62,824	6,618	509,795
1948	405,492	34,848	56,662	7,012	504,014
1949	310,658	35,215	53,990	11,072	410,935

Consumption

1942	2,579	6,833	22	8,217	17,651
1943	131,977	26,205	304	12,405	170,891
1944	495,552	46,243	10,763	14,112	566,670
1945	600,145	42,394	43,012	8,029	693,580
1946	632,126	44,357	79,228	5,988	761,699
1947	448,589	37,703	68,838	4,536	559,666
1948	345,313	32,118	58,870	5,771	442,072
1949	320,878	31,798	52,661	8,716	414,053

Exports

1942	222	1,037	...	160	1,419
1943	14,937	2,540	40	631	18,148
1944	98,380	4,799	530	557	104,266
1945	76,555	5,837	980	406	83,778
1946	68,763	2,642	495	797	72,697
1947	7,951	2,617	62	755	11,385
1948	1,093	2,875	21	885	4,874
1949	1,403	3,330	178	1,577	6,488

Stocks at End of Period

1942	1,050	1,786	4	1,772	4,612
1943	30,975	6,415	1,033	3,145	41,568
1944	116,130	11,739	9,892	5,166	142,927
1945	170,571	9,703	18,378	4,802	203,454
1946	81,483	10,470	19,478	3,755	115,186
1947	40,606	5,237	13,184	3,339	62,366
1948	96,282	5,072	10,995	2,762	115,111
1949	77,768	4,794	12,102	3,541	98,205

Source: Rubber Division, OMD, and Predecessor Agencies.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures for GR-M and Buna N Types include production of privately-owned plants.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1942	1943	1944	1945	1946	1947	1948	1949
Jan.	49,216	36,085	47,540	52,008	51,746	57,057	61,308	63,083
Feb.	42,666	36,274	47,754	48,856	47,654	50,551	56,487	57,934
Mar.	50,820	41,586	52,263	55,364	56,703	59,947	68,171	73,118
Apr.	49,554	48,177	50,005	59,024	62,111	64,140	72,183	75,279
May	53,212	49,828	54,230	60,748	66,800	70,865	77,186	81,622
June	50,077	53,325	54,266	60,580	63,247	71,329	78,044	83,338
July	54,606	49,867	55,119	66,170	60,076	73,441	81,428	82,118
Aug.	48,793	51,880	55,618	70,058	66,729	72,089	80,351	84,632
Sept.	50,093	49,707	56,318	64,529	62,268	71,384	76,159	80,760
Oct.	50,094	53,111	53,154	55,708	66,637	73,277	75,164	79,253
Nov.	50,729	50,703	54,967	53,543	61,345	64,158	72,560	76,270
Dec.	39,250	48,695	52,250	49,745	61,101	67,506	72,162	75,470
Total	589,110	568,238	633,482	696,333	735,417	795,015	871,270	912,877

Source: U. S. Bureau of Mines.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	Production	Consumption—Tons	Consumption—% to Crude [a]	Exports	Stocks On Hand at End of Period
1936	150,571	141,486	24.6	7,085	19,000
1937	185,033	162,000	29.8	13,233	28,800
1938	122,400	120,800	27.6	7,403	23,000
1939	186,000	170,000	28.7	12,611	25,250
1940	208,971	190,244	29.3	11,347	32,636
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007[b]	254,820	64.6	30,405	42,532
1943	304,058[c]	291,082	59.6	15,678	46,201
1944	260,631[d]	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,612	275,410	26.5	14,461	33,666
1947	291,395	288,395	24.8	14,556	35,943
1948	266,861	261,113	24.4	11,428	32,630
1949	223,990	222,716	22.5	10,367	28,452
1948:					
Nov.	23,050	22,170	24.8	1,210	33,378
Dec.	21,430	21,377	26.3	1,375	32,630
1949:					
Jan.	19,741	19,031	21.9	991	32,868
Feb.	18,270	17,712	21.9	1,012	32,738
Mar.	19,991	19,508	21.2	1,054	33,397
Apr.	18,463	18,649	22.1	1,070	32,825
May	18,184	18,323	22.5	887	32,326
June	18,849	19,316	23.0	694	30,684
July	14,626	15,966	22.6	681	29,126
Aug.	17,813	19,297	24.2	612	27,526
Sept.	18,304	18,517	24.2	761	26,257
Oct.	20,683	19,638	23.3	1,107	26,619
Nov.	19,382	18,512	22.1	796	27,801
Dec.	19,684	18,247	21.7	702	28,452

Source: 1936-40, Department of Commerce; 1941 to date, Rubber Division, OMD, and Predecessor Agencies.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (a) Includes natural and synthetic rubber. (b) Includes 893 tons of imports. (c) Includes 67 tons of imports. (d) Includes 21 tons of imports.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1930	2,784,745	571,241	3,355,986	1940	3,692,328	721,637	4,413,965
1931	1,973,090	416,648	2,389,738	1941	3,744,500	875,381	4,619,681
1932	1,135,491	235,187	1,370,678	1942	220,814	133,083	353,897
1933	1,573,512	346,545	1,920,057	1943	0	4,501	4,501
1934	2,177,919	575,192	2,753,111	1944	0	124,819	124,819
1935	3,252,244	694,690	3,946,934	1945	83,792	313,643	397,435
1936	3,669,528	781,862	4,451,390	1946	2,148,699	930,760	3,079,459
1937	3,915,889	892,382	4,808,271	1947	3,558,178	1,220,634	4,778,812
1938	2,000,985	485,852	2,486,837	1948	3,909,270	1,363,856	5,273,126
1939	2,866,796	704,308	3,571,104	1949	5,108,841	1,123,736	6,232,577
1948:							
Jan.	305,081	99,200	404,281	July	356,764	116,780	473,544
Feb.	274,847	107,054	381,901	Aug.	348,782	111,760	460,542
Mar.	349,998	140,606	490,604	Sept.	301,170	111,224	412,394
Apr.	308,071	128,963	437,034	Oct.	383,756	107,352	491,108
May	225,461	111,789	337,250	Nov.	364,440	103,837	468,277
June	312,406	117,572	429,978	Dec.	378,455	107,702	486,157
1949:							
Jan.	326,019	104,599	430,618	July	483,261	95,348	578,609
Feb.	324,547	101,700	426,247	Aug.	557,370	99,850	657,220
Mar.	402,402	115,171	517,573	Sept.	534,493	91,389	625,882
Apr.	436,392	106,212	542,604	Oct.	487,891	84,704	572,595
May	394,703	86,200	480,903	Nov.	381,951	72,749	667,881
June	493,882	99,126	593,008	Dec.	285,930	66,688	352,618

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Rim Production

	1945	1946	1947	1948	1949
Passenger Car	4,504,368	15,038,469	21,346,004	23,842,796	27,715,344
Truck & Bus	6,386,652	5,939,244	7,737,353	6,920,231	6,238,174
Agricultural	1,441,909	1,735,992	2,633,699	3,140,882	2,695,430
Earth Mover	1,308	5,520	10,610	13,330	9,895
Total	12,434,237	22,739,225	31,727,666	33,917,239	34,658,843

	1949					
	July	Aug.	Sept.	Oct.	Nov.	Dec.
Passenger Car	2,260,020	3,023,981	3,014,872	2,478,051	1,332,637	2,312,926
Truck & Bus	344,984	310,351	293,933	268,408	189,423	449,357
Agricultural	154,913	233,734	207,691	194,837	135,976	225,703
Earth Mover	964	531	353	155	809	578
Total	2,760,881	3,568,597	3,516,849	2,941,451	1,658,845	2,988,564

Source: The Tire & Rim Association, Inc.

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Automotive Pneumatic Casings

(Thousands of Units)

	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1938 (total)	**11,516**	**30,567**	**1,049**	**43,132**	**40,907**	**8,451**
Passenger Car.	10,086	27,104	580	37,770	35,789	6,937
Truck and Bus	1,430	3,463	469	5,362	5,118	1,514
1939 (total)	**18,208**	**38,022**	**1,279**	**57,509**	**57,613**	**8,665**
Passenger Car.	15,742	33,471	607	49,820	49,933	7,108
Truck and Bus	2,466	4,551	672	7,689	7,680	1,557
1940 (total)	**22,252**	**35,346**	**1,176**	**58,774**	**59,186**	**9,127**
Passenger Car.	19,560	30,903	411	50,874	50,965	7,270
Truck and Bus	2,692	4,443	765	7,900	8,221	1,857
1941 (total)	**24,780**	**39,895**	**1,489**	**66,164**	**61,540**	**4,436**
Passenger Car.	19,855	34,119	586	54,560	50,392	3,165
Truck and Bus	4,925	5,776	903	11,604	11,148	1,271
1942 (total)	**6,680**	**8,872**	**207**	**15,759**	**15,351**	**6,247**
Passenger Car.	910	2,734	38	3,682	2,790	4,432
Truck and Bus	5,770	6,138	169	12,077	12,561	1,815
1943 (total)	**6,128**	**18,547**	**225**	**24,900**	**20,423**	**1,883**
Passenger Car.	82	10,606	71	10,759	7,620	1,132
Truck and Bus	6,046	7,941	154	14,141	12,803	751
1944 (total)	**6,654**	**26,439**	**263**	**33,356**	**33,446**	**2,013**
Passenger Car.	208	18,330	130	18,668	18,819	1,218
Truck and Bus	6,446	8,109	133	14,688	14,627	795
1945 (total)	**5,984**	**36,479**	**504**	**42,967**	**44,524**	**3,077**
Passenger Car.	1,115	25,463	222	26,800	28,200	2,214
Truck and Bus	4,869	11,016	282	16,167	16,324	863
1946 (total)	**15,310**	**65,490**	**1,512**	**82,312**	**82,298**	**2,448**
Passenger Car.	11,086	54,684	653	66,423	66,466	1,763
Truck and Bus	4,224	10,806	859	15,889	15,832	685
1947 (total)	**25,056**	**62,871**	**3,256**	**91,183**	**95,550**	**6,949**
Passenger Car.	19,644	52,857	1,608	74,109	77,795	5,444
Truck and Bus	5,412	10,014	1,648	17,074	17,755	1,505
1948 (total)	**26,845**	**49,148**	**1,787**	**77,781**	**81,314**	**10,698**
Passenger Car.	21,589	41,295	656	63,540	66,738	8,773
Truck and Bus	5,256	7,853	1,132	14,241	14,576	1,925
1949 (total)	31,588	43,474	1,467	76,530	76,372	10,651
Passenger Car.	28,125	36,432	509	65,066	65,143	8,913
Truck and Bus	3,463	7,042	958	11,463	11,228	1,738
1949:						
Sept. (total)	3,056	3,576	114	6,746	5,604	8,936
Passenger Car.	2,832	2,944	44	5,821	4,951	7,125
Truck and Bus	223	632	70	925	653	1,812
Oct (total)	2,942	3,740	158	6,840	6,500	8,675
Passenger Car.	2,712	3,005	68	5,785	5,621	7,016
Truck and Bus	230	735	90	1,055	879	1,659
Nov. (total)	1,746	3,422	99	5,267	6,040	9,542
Passenger Car.	1,578	2,752	41	4,371	5,135	7,867
Truck and Bus	169	670	58	896	904	1,675
Dec. (total)	2,158	2,944	131	5,234	6,275	10,651
Passenger Car.	1,903	2,324	47	4,274	5,260	8,913
Truck and Bus	255	620	84	960	1,015	1,738

Source: The Rubber Manufacturers Association, Inc.

Cotton, Rayon and Nylon Tire Fabrics

(Production in Thousands of Pounds)

	Cotton: Tire Cord Not Woven	Cotton: Cord Fabric Woven	Cotton: Chafer and All Other Tire Fabrics	Cotton: Total	Rayon and Nylon: Tire Cord Not Woven	Rayon and Nylon: Tire Cord And Other Tire Fabrics	Rayon and Nylon: Total
1946:							
Jan.-Mar.	**17,128**	**39,377**	**15,245**	**71,750**	*a*	**51,208**	**51,208**
Apr.-June	**19,622**	**40,197**	**18,623**	**78,442**	*a*	**52,511**	**52,511**
July-Sept.	**17,279**	**39,259**	**18,787**	**75,325**	**5,102**	**46,932**	**52,034**
Oct.-Dec.	**20,660**	**42,668**	**21,708**	**85,036**	**5,858**	**50,589**	**56,447**
Total	74,689	161,501	74,363	310,553	10,960	201,240	212,200
1947:							
Jan.-Mar.	**21,972**	**49,377**	**21,815**	**93,164**	**5,322**	**52,059**	**57,381**
Apr.-June	**23,491**	**53,746**	**16,480**	**93,717**	**5,486**	**47,360**	**52,846**
July-Sept.	**15,571**	**44,291**	**14,596**	**74,458**	**6,161**	**51,719**	**57,880**
Oct.-Dec.	**18,183**	**48,532**	**17,762**	**84,477**	**6,550**	**55,078**	**61,628**
Total	79,217	195,946	70,653	345,816	23,519	206,216	229,735
1948:							
Jan.-Mar.	**18,546**	**50,251**	**19,391**	**88,188**	*a*	**60,569**	**60,569**
Apr.-June	**15,585**	**45,385**	**18,213**	**79,183**	*a*	**59,759**	**59,759**
July-Sept.	29,743	45,927	*c*	75,670	*a*	63,642	63,642
Oct.-Dec.	13,321	34,424	15,879	63,624	*a*	65,258	65,258
Total	77,195	175,987	53,483	306,665	.....	249,228	249,228
1949:							
Jan.-Mar.	*d*	33,213	25,395	56,608	*a*	68,296	68,926
Apr.-June	5,309	29,114	13,617	48 040	*a*	68,269	68,269
July-Sept.	1,343	16,620	11,141	29,104	15,640	55,969	71,609
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: U. S. Bureau of the Census.

Notes: (a) Included with tire cord and fabrics to avoid disclosures of operations of individual mills. (b) Fuel cell fabrics are not included with rayon and nylon tire cord and fabrics. (c) Included with tire cord not woven. (d) Included with chafer and all other tire fabrics.

Automotive Inner Tubes

(Thousands of Units)

	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1936	21,514	32,188	721	54,423	57,036	10,945
1937	**22,464**	**29,554**	**749**	**52,767**	52,373	10,312
1938	**11,515**	**28,134**	**644**	**40,293**	**37,848**	**8,166**
1939	**18,190**	**31,998**	**1,002**	**51,190**	**50,649**	**7,036**
1940	**22,172**	**29,070**	**972**	**52,214**	**52,237**	**7,017**
1941	**24,722**	**33,749**	**1,232**	**59,703**	**57,433**	**4,686**
1942	**6,895**	**7,213**	**159**	**14,267**	**12,685**	**6,206**
1943	**6,350**	**12,474**	**189**	**19,014**	**15,014**	**2,626**
1944	**6,460**	**20,569**	**196**	**27,224**	**27,488**	**2,813**
1945	**5,988**	**33,906**	**411**	**40,304**	41,742	3,627
1946	**15,327**	**59,357**	**1,424**	**76,108**	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,535	31,923	891	64,349	65,564	10,713
1949:						
May	2,380	2,830	87	5,296	6,088	12,410
June	3,231	3,106	72	6,409	6,430	12,466
July	3,107	3,127	64	6,230	5,230	11,364
Aug.	3,190	3,351	61	6,603	5,169	9,858
Sept.	3,007	2,766	69	5,483	4,902	8,916
Oct.	2,940	2,538	79	5,557	5,296	8,644
Nov.	1,746	2,415	55	4,216	5,155	9,645
Dec.	2,172	1,993	58	4,222	5,339	10,713

Source: The Rubber Manufacturers Association, Inc.

Smoked Sheets—Spot Closing Prices

(New York Market—Cents per pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1910	288	141	206.60	1930	16½	7½	11.98
1911	184	114	141.30	1931	8⅜	4¼	6.17
1912	140	108	121.60	1932	4¼	2½	3.49
1913	113	59	82.04	1933	9¾	2¾	5.96
1914	93	56	65.33	1934	15⅞	8¼	12.92
1915	79	58½	65.85	1935	13¾	10½	12.37
1916	102	55	72.50	1936	23	13⅞	16.41
1917	90	52	72.23	1937	26½	14	19.39
1918	70	40	60.15	1938	17⅛	10¼	14.64
1919	57	38½	48.70	1939	24	14⅜	17.57
1920	56½	16	36.30	1940	24	18¼	20.10
1921	21¾	11¾	16.36	1941	24⅜	19¼	22.40
1922	28¾	13⅜	17.50	1942	22½	22½	22.50
1923	37½	24¾	29.45	1943	22½	22½	22.50
1924	40¼	17⅜	26.20	1944	22½	22½	22.50
1925	121	34⅜	72.46	1945	22½	22½	22.50
1926	88½	36¾	48.50	1946	22½	22½	22.50
1927	41¾	33	37.72	1947	25	14	20.00
1928	41¼	17	22.48	1948	25	18	21.99
1929	26⅞	15½	20.55	1949	19¾	15⅞	17.57

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1943	1944	1945	1946	1947	1948	1949	1950
Jan.	21.34	20.76	22.39	25.49	32.58	36.09	33.37	31.89
Feb.	21.61	21.34	22.59	26.57	33.91	33.63	33.41	32.79
Mar.	21.98	21.65	22.43	27.52	35.89	35.04	33.44	.....
Apr.	22.02	21.71	21.88	28.40	35.89	38.10	33.84	.....
May	21.97	21.63	23.30	28.17	36.51	38.57	33.73	.....
June	21.92	23.31	23.42	29.89	37.83	38.12	33.56	.....
July	21.46	22.33	23.27	34.11	38.03	34.89	32.99	.....
Aug.	21.09	22.11	23.10	36.31	34.83	32.23	32.06	.....
Sept.	21.10	22.10	23.25	37.59	32.21	31.92	30.94	.....
Oct.	21.00	22.32	23.85	36.79	32.39	32.01	30.32	.....
Nov.	20.32	22.13	24.71	37.50	34.50	32.15	30.52	.....
Dec.	20.32	22.28	25.21	33.03	36.74	32.90	31.08	.....
Average for Year	21.34	21.89	23.25	31.28	35.11	34.64	32.44	.....

Consumption of Vinyl Resins

(In Thousands of Pounds)

	Sheeting and Film [a]	Textile and Paper Coating Resins [b]	Molding and Extrusion Materials [b]	All Other [b, c]
1946	**52,080**	**11,673**	**61,852**	**27,083**
1947	**66,430**	**17,237**	**73,114**	**27,064**
1948	98,021	31,085	73,598	21,147
1949	157,544	29,470	81,842	19,792
1949:				
May	10,986	2,212	4,817	1,406
June	10,827	2,177	5,592	1,136
July	10,020	1,901	5,560	994
Aug.	12,849	2,125	6,330	816
Sept.	15,818	2,632	7,807	1,718
Oct.	17,354	2,675	9,058	1,383
Nov.	18,171	3,094	9,254	1,740
Dec.	16,567	2,955	10,586	1,781

Source: Bureau of the Census.

Notes: (a) Includes weight of fillers, plasticizers, extenders and safety glass sheeting; (b) Resin content; (c) Includes Adhesives, but excludes data for protective coating resins.

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for all purposes

Rubber Industry Employment, Wages and Hours

All Rubber Products

	1948				1949			
Mo.	Production Workers (thousands)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings	Production Workers (thousands)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings
Jan.	220	$56.63	39.6	$1.430	201	$56.89	37.9	$1.501
Feb.	219	54.35	38.6	1.408	197	56.55	37.7	1.500
Mar.	215	53.09	38.0	1.397	194	55.43	37.0	1.498
Apr.	208	53.24	38.0	1.401	190	55.50	36.9	1.504
May	203	55.28	38.9	1.421	185	57.08	37.7	1.514
June	205	57.33	39.7	1.444	181	58.29	38.2	1.526
July	201	58.32	39.7	1.469	177	58.37	38.4	1.520
Aug.	205	60.33	40.3	1.497	180	57.72	38.3	1.507
Sept.	207	59.25	39.5	1.500	167	60.97	40.3	1.513
Oct.	208	58.96	39.2	1.504	186	59.57	39.4	1.512
Nov.	209	58.20	38.7	1.504	186	58.06	38.5	1.508
Dec.	206	57.67	38.5	1.498	186	59.38	39.3	1.511

Tires and Tubes

Jan.	104.0	62.60	38.1	1.643	91.3	60.72	35.3	1.720
Feb.	102.3	58.19	36.1	1.612	89.4	60.99	35.4	1.723
Mar.	99.6	55.61	34.8	1.598	88.6	61.50	35.8	1.718
Apr.	95.7	56.64	35.4	1.600	88.6	60.92	35.4	1.721
May	94.4	61.24	37.5	1.633	87.2	63.20	36.3	1.741
June	95.0	64.15	38.9	1.649	86.3	64.09	36.6	1.751
July	94.0	66.10	39.3	1.682	82.0	64.45	36.6	1.761
Aug.	94.7	68.26	39.5	1.728	80.9	62.32	36.0	1.731
Sept.	94.4	65.57	37.9	1.730	64.3	70.03	39.1	1.791
Oct.	93.1	64.50	37.2	1.734	81.1	64.83	37.3	1.738
Nov.	94.3	62.66	36.2	1.731	81.3	64.02	36.9	1.735
Dec.	92.7	61.29	35.6	1.719	....	65.28	37.3	1.750

Rubber Footwear

Jan.	24.6	50.90	42.1	1.209	24.8	51.86	40.2	1.290
Feb.	24.9	50.33	41.7	1.207	22.9	48.15	37.5	1.284
Mar.	24.7	51.03	42.1	1.212	21.9	42.07	33.6	1.252
Apr.	24.2	50.33	41.7	1.207	21.4	46.65	37.2	1.254
May	23.9	50.21	41.6	1.207	20.5	49.45	38.9	1.257
June	24.0	50.33	41.7	1.207	19.8	50.35	39.4	1.278
July	22.8	51.32	42.1	1.219	20.2	48.84	38.7	1.262
Aug.	24.2	51.79	41.5	1.248	20.3	48.78	38.9	1.254
Sept.	24.7	52.46	41.5	1.264	21.1	51.71	40.4	1.280
Oct.	25.2	53.26	42.0	1.268	21.5	49.81	39.1	1.274
Nov.	25.5	54.04	41.6	1.299	22.2	50.55	39.9	1.267
Dec.	25.9	54.82	42.3	1.296	....	50.31	39.8	1.264

All Other Rubber Products

Jan.	91.8	51.36	40.6	1.265	85.3	54.38	40.1	1.356
Feb.	91.6	51.20	40.6	1.261	85.1	54.05	40.1	1.348
Mar.	90.5	50.70	40.3	1.258	83.1	52.49	39.2	1.339
Apr.	88.4	50.18	39.7	1.264	79.6	51.69	38.4	1.346
May	84.6	49.94	39.6	1.261	77.2	52.41	39.1	1.343
June	86.4	51.85	40.1	1.293	75.3	53.85	39.8	1.353
July	84.5	51.38	39.4	1.304	74.5	54.11	40.2	1.346
Aug.	85.9	53.90	40.8	1.321	78.6	52.46	40.6	1.366
Sept.	97.9	54.28	40.6	1.337	81.4	56.28	41.2	1.366
Oct.	89.3	54.84	40.5	1.354	83.3	57.06	41.5	1.375
Nov.	88.9	54.54	40.4	1.350	82.0	54.09	39.6	1.366
Dec.	87.2	54.88	40.5	1.355	....	55.90	41.1	1.360

Source: U. S. Departments of Commerce and Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who worked during or received pay for the pay period ending nearest the 15th of the month. The employment series have been adjusted to levels indicated by Federal Security Agency data for 1947, and have been carried forward from 1947 bench-mark levels, thereby providing consistent series. Hours and earning data pertain only to production and related workers.

Production Index for the Rubber Industry

Production 1935-1939 = 100

(Based on man-hours)

	1947	1948	1949		1947	1948	1949
Jan.	247	223	193	July	207	200	175
Feb.	246	215	188	Aug.	210	207	178
Mar.	239	205	182	Sept.	217	205	202
Apr.	234	200	177	Oct.	223	205	197
May	220	201	178	Nov.	225	203	195
June	216	205	178	Dec.	230	200	192

Source: U. S. Department of Commerce.

Sales by the Rubber Industry

(In Millions of Dollars)

	1947	1948	1949		1947	1948	1949
Jan.	289	271	260	July	290	331	271
Feb.	299	265	251	Aug.	291	331	295
Mar.	302	270	260	Sept.	315	317	277
Apr.	291	285	257	Oct.	309	294	262
May	276	273	248	Nov.	311	291	....
June	271	299	266	Dec.	276	280	....

Source: U. S. Department of Commerce.

Rubber Manufacturers' Inventories

(Based upon Book-Value)

(In Millions of Dollars)

	1947	1948	1949		1947	1948	1949
Jan.	502	608	661	July	588	648	625
Feb.	519	625	661	Aug.	566	641	586
Mar.	534	634	653	Sept.	553	661	562
Apr.	564	625	648	Oct.	552	650	537
May	584	632	650	Nov.	550	667	....
June	593	645	644	Dec.	579	650	....

Source: U. S. Department of Commerce.

Various Compounding Materials Consumed by the Rubber Industry

Material	1942	1943	1944	1945	1946	1947	1948
Asphalt [a]							
Short tons	22,263	16,510	20,189	19,483	28,715	32,113	19,967
% of total	.006	.005	.006	.005	.007	.007	.004
Barite (Barytes):							
Short tons	6,334	8,000	10,000	10,000	20,000	17,000	18,000
% of total	3.6	3.9	2.9	2.1	4.4	3.1	2.85
Carbon Black:							
Short tons	147,974	236,737	369,015	402,193	470,732	471,790	424,038
% of total	88.5	90.3	94.6	95.5	95.3	94.3	91.0
Clay, Kaolin:							
Short tons	51,334	50,964	59,588	109,936	162,393	166,201	176,965
% of total	5.1	5.5	6.8	11.7	12.3	11.5	11.3
Clay, Fire & Stoneware:							
Short tons	5,000	10,259	7,160	7,800	12,951	17,970	15,480
% of total	0.1	0.2	0.1	0.1	0.2	0.2	0.2
Lead Sulfate, Basic:							
Short tons	89	131	268	200	....	.....	.....
% of total	1.1	2.3	4.2	5.2	..	..	..
Lime:							
Short tons	1,381	2,039	5,634	7,170	3,193	589	.....
% of total	0.02	0.05	0.13	0.10	0.1	0.01	..
Litharge:							
Short tons	3,460	4,302	3,023	1,864	2,131	2,205	2,835
% of total	3.8	3.8	2.2	1.3	1.6	1.3	1.8
Lithopone:							
Short tons	1,047	1,078	726	977	1,607	3,085	4,192
% of total	0.8	0.8	0.5	0.7	1.1	1.9	3.0
Mica, Ground:							
Short tons	1,754	3,063	1,137	3,715	4,951	3,900	.....
% of total	3.7	6.0	2.2	7.1	8.0	6.0	..
Sulfur:							
Short tons	40,000	51,000	63,000	64,960	72,800	72,800	70,560
% of total	1.4	1.8	1.9	2.0	2.2	1.8	1.7
Talc [b]							
Short tons	40,487	48,994	51,833	63,758*	65,980	71,840	66,226
% of total	10.0	11.8	13.0	16.0	14.4	13.9	13.0
Zinc Oxide:							
Short tons	52,717	67,898	59,518	63,447	83,776	82,248	82,895
% of total	53.0	47.4	42.3	49.6	53.1	51.2	54.9

Source: U. S. Bureau of Mines.

Notes: (a) Solid and semi-solid products of less than 200 penetration. (b) Includes pyrophyllite and ground soapstone. * Revised.

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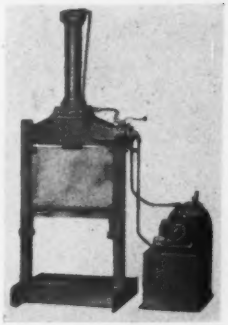

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